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Validation of Aircrew Training Manual Practice Iteration Requirements

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Seventy-nine staff aviators at the U.S. Army Aviation Center (USAANVC) participated in a 6-month test period in which they flew either zero, two, four, or six iterations of 47 FAC 2 contact and terrain flight tasks in the UH-1 aircraft. The results indicate that average level of performance in helicopter contact and terrain flight tasks is maintained after 6 months of no practice. The average level of performance does not significantly improve with as many as six practice iterations. These findings are true regardless of a) total career flight hours or b) whether the tasks are psychomotor or procedural. The results (continued)

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also indicate that overall checkride performance can be predicted reliably from performance on a small number of tasks. Additional research is needed to determine the amount of skill decay that occurs for a) no-practice periods longer than 6 months, and b) emergency, instrument, night, and mission-specific tasks not investigated in this research.

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FOREWORD

The Fort Rucker Field Unit of the Army Research Institute for the Behavioral and Social Sciences (ARI) has as its primary responsibility the conduct of research and the development of products that serve to increase the effectiveness of Army aviator training--both institutional training and unit training. An important part of this research is to understand the type and amount of training required to sustain the flying skills that aviators initially acquire in the Army Initial Entry Rotary Wing (IERW) course.

This research was designed to make an empirical determination of the minimum of semiannual practice iterations necessary to maintain proficiency on a selected sample of flying tasks. The research was performed in response to a request by the U.S. Army Aviation Center (USAAVNC) Directorate of Evaluation and Standardization (DES).

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CW3 David E. Broadnax, CW3 Gerald L. Whitaker, Flight Standardization Division, Directorate of Evaluation and Standardization, and CW4 Troy D. Brown and CW3 Al Boniface, Individual Aviator and Instrument Qualification Branch, Directorate of Training and Doctrine, served as standardization instructor pilots for the checkrides. Staff instructor pilots served as instructor pilots for the practice flights. Staff aviators served as subjects for the research. Personnel from the Training and Support Division, Directorate of Training and Doctrine, provided valuable assistance for scheduling aircraft and stagefields.

EXECUTIVE SUMMARY

Requirement:

Because of the high cost of flying hours and the increasing demands on aviators' mission flight skills, a need exists to validate the number of semiannual task iterations required by the Army Aircrew Training Manuals (ATMs) to maintain individual flying proficiency. The existing requirements were defined by aviation subject matter experts (SMEs) and have not been empirically confirmed. The research reported in this paper was conducted to provide empirical data regarding the minimum number of task iterations required to maintain proficiency in contact and tactical tasks in the UH-1 aircraft over a 6-month test period.

Procedure:

Seventy-nine staff aviators at the U.S. Army Aviation Center (USAAVNC) participated in a 6-month test period in which they flew either zero, two, four, or six iterations of 47 FAC 2 contact and terrain flight tasks in the UH-1 aircraft. Aviators' checkride performance was evaluated at the beginning (Initial Checkride Pretest) and at the end (Final Checkride Posttest) of the test period by standardization instructor pilots (SIPs). The dependent variable was subjects' checkride scores. Independent variables were the number of practice iterations, number of career flight hours, pretest-posttest periods, and ATM tasks. In addition, the reliability of aviators' self-rated confidence to perform checkride tasks to ATM standards was evaluated as a potential predictor of checkride performance.

Findings:

The results indicate that average level of performance in helicopter contact and terrain flight tasks is maintained after 6 months of no-practice. The average level of performance does not significantly improve with as many as six practice iterations. These findings are true regardless of (a) total career flight hours or (b) whether the tasks are psychomotor or procedural. In short, the results do not support the requirement for aviators to perform current semiannual minimum FAC 2 iterations for the majority of ATM contact and terrain flight tasks.

A factor analysis of final checkride data revealed the presence of six independent task dimensions. This finding suggests that a selected set of 10 tasks could be used to predict overall checkride performance with a reliability (R^2) of .87. Aviators' self-rated confidence in their ability to perform a task to ATM standards was found to be a nonreliable predictor of actual performance of the tasks.

Additional research is needed to determine the amount of skill decay that occurs for (a) no-practice periods longer than 6 months, and (b) emergency, instrument, night, and mission-specific tasks not investigated in this study.

Utilization of Findings:

The results of this research should be taken into account in implementing changes to the current ATM program. Two specific recommendations are (a) modification of iteration performance requirements, and (b) redirection of evaluation emphasis during checkrides.

VALIDATION OF AIRCREW TRAINING MANUAL PRACTICE ITERATION REQUIREMENTS

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PROBLEM

Aircrew Training Manuals (ATMs) are designed to help the aviation unit commander implement and monitor training in his unit and to standardize the individual aviator training program. ATM training is designed to ensure that each aviator achieves and maintains individual flight proficiency. The ATMs contain requirements for the minimum number of task iterations to be accomplished by individual aviators during a six-month period of continuation training. The iteration requirements were defined by a panel of subject matter experts (SMEs). Because the cost of flying hours and the demands on aviators' mission skills continue to increase, a need exists to make an empirical determination of the minimum number of ATM task iterations necessary to maintain individual flying proficiency. The U.S. Army Research Institute (ARI) was requested by the U.S. Army Aviation Center (USAAVNC) Directorate of Evaluation and Standardization (DES) to validate the ATM requirements.

BACKGROUND

Development of the ATMs

With the introduction of the Aviation Career Incentive Act of 1974, Congress and the General Accounting Office established that the Army's flying hour program would be acceptable for funding only if it was fully justified. At that time, the Army was less able than the other services to demonstrate a definitive program of training that carried the aviator through qualification, mission, and continuation training and that identified the specific tasks required in each phase of training. For continuation training,[1] the Army developed a flying hour program requiring 80 hours for each aviator; no satisfactory explanation could be given as to how and for what benefit these hours were being used (Lovejoy & Presley, 1980).

At the direction of the Vice Chief of Staff of the Army, a special task force from the Army Training and Doctrine Command (TRADOC) was created in late 1976 to develop a flying hour program designed to ensure combat readiness. The initial ATMs were drafted by members of the special task force. The ATMs specified the estimated amount of training required to train individual aviators to an acceptable level of proficiency (qualification and mission training) and to sustain proficiency at that level (continuation training). In addition, the TRADOC task

[1] The research described in this paper addresses Army ATM continuation training requirements in general, with particular emphasis on training requirements for FAC 2 aviators. The part of continuation training that is designated for Army FAC 2 aviators has also been called "proficiency flying."

force established specific annual training criteria, identified tasks for individual aviators by type of aircraft, defined semiannual training requirements, and related the training requirements to flying hours. The latest version of the ATMs was distributed to the field in FY 81.

The ATMs were developed to help the unit commander fulfill his responsibility for assessing the combat-ready status of the unit, for identifying performance deficiencies of individual aviators, and for developing and implementing the required training program. Although portions of the program are mandated in order to standardize training, the program is sufficiently flexible to enable commanders to tailor training programs to the needs of their unit and the individual aviators within the unit.

ATM Training Requirements

The training requirements that a commander determines to be appropriate for an individual aviator depend on the Aviator Readiness Level (ARL) and Flight Activity Category (FAC) of the aviator. Each aviator is classified into an ARL according to the training status of that individual. Aviators are classified as ARL 1 only if they have completed mission training and are considered to be combat ready. Aviators are classified into other ARLs if they are a) participating in mission, refresher, or qualification training, b) assigned to a non-operational flying position, or c) restricted from flying for administrative or medical reasons.

Flight Activity Categories (FACs) are classifications of aviator positions. Aviators placed in FAC 2 positions typically occupy "career-broadening" assignments in which flying does not constitute a major part of their job. To minimize the potential deterioration of flight skills during such assignments, FAC 2 aviators are required to fly a minimum amount of hours per calendar period to maintain basic flight skills. The task list for a FAC 2 position consists of all FAC 2 tasks given in the ATMs plus any tactical/special, mission, and additional tasks that the commander designates as supporting Army training readiness goals (Department of the Army, 1981).

Aviators designated as FAC 1 perform combat, combat support, or combat service support missions. FAC 1 aviators are required to be proficient in the tactical tasks appropriate for the type of aircraft flown and for the particular mission of their unit. The commander determines the employment role for each position he designates as FAC 1 and develops a task list for that position. The task list for a FAC 1 position consists of all FAC 2 tasks, plus the FAC 1 tasks and the additional tasks not included in the ATM that the commander considers appropriate.

ARL 1 aviators in FAC 1 and FAC 2 positions are required to complete a minimum number of task iterations and flying hours during a six-month continuation training period. The ATMs specify the conditions under which each task is to be performed and the standards of acceptable performance. Both the iteration and flying hour requirements were analytically formulated by a panel of subject matter experts (SMEs) but were not empirically confirmed. It has been assumed that the number of iterations for each task and flying hour requirements are the minimum necessary to maintain proficiency over a six-month period.

RELEVANT RESEARCH

Task Performance

To develop an approach to validate the ATM iteration requirements for continuation training, literature on the retention of psychomotor and procedural skills was examined. The most frequently cited finding in the retention literature is that procedural skills decay after relatively short intervals of no practice (weeks, months), while psychomotor skills are generally well retained over extended no-practice intervals (months, years) (Mengelkoch, Adams, & Gainer, 1960; Prophet, 1976; Schendel, Shields, & Katz, 1978). Level of original learning is the single most important factor influencing how well psychomotor and procedural skills are retained following a period of no practice. The amount of proficiency loss depends on the length of the no-practice period; however, the absolute rate proficiency loss is approximately the same for individuals of varying initial ability levels (Schendel, Shields, & Katz, 1978).

In addition, several other variables have been found to affect retention; the two most operationally relevant variables are the type of tasks (i.e., psychomotor or procedural) and the activities an individual engages in during the retention interval. It has been shown that these variables often interact to affect retention (Naylor & Briggs, 1961; Gardlin & Sitterley, 1972).

Some research has focused specifically on the retention of flying skills. Although many studies deal with intervals of non-flying that are typically longer than those of concern in the present research, their findings are nonetheless of interest.

Smith and Matheny (1976) examined the level of skill retention among returning Air Force prisoners of war. Subjects' flight hours ranged from 300 to 7000 hours, and time away from flying ranged from 13 months to 102 months. The results indicate that contact flight skills were retained longer and were more quickly relearned than were instrument, procedural, and verbal skills. Aviators with less than 1,000 hours of flight time required significantly more hours to retrain than aviators with more than 1,000 flight hours.

Sitterley and his colleagues (e.g., Sitterley & Berge, 1972) examined the retention of procedural and continuous control skills for periods of one to six months for subjects flying simulated manned spacecraft. Their results indicate that time to execute procedural tasks increased significantly after only a one-month period of no practice. Proficiency on continuous control tasks decreased moderately for the first three months and rapidly from three months to six months.

In a review of literature relevant to Army proficiency flying, Wright (1969) was in agreement with the previously mentioned findings concerning the relative rates of proficiency loss for psychomotor and procedural skills, the importance of amount of initial learning, and the relationship between amount of proficiency loss and the length of the no-practice interval. In addition, he concluded that (a) flight skills are retained well for periods of up to two years, (b) skills that decay can be retrained quickly, (c) forgetting curves for flight skills are negatively accelerated, and (d) initial retention performance is affected by the similarity of both the original learning task and interpolated tasks to the retention task.

Wright (1973) gathered Army aviators' self-ratings of skill levels achieved during proficiency training and refresher training following periods of nonflying as long as 36 months. His findings indicate that the amount of <u>self-rated</u> skill decrement and the amount of refresher training required are similar for aviators who engaged in proficiency flying and those who did no flying during equal periods. Self-rated basic visual flight skills remained at acceptable proficiency levels for nonflying or proficiency flying periods as long as 36 months; but, for one-half of the aviators in the study, self-rated instrument flight skills fell below acceptable levels within 12 months .

A small-scale study by the Human Resources Research Organization (HumRRO, 1974) obtained instrument flight performance data on aviators who were retrained in the 2B24 helicopter simulator. This simulator is motion-based but is not equipped with an external visual scene. The results indicate that aviators who are in proficiency flying assignments require approximately the same number of simulator training hours to pass an instrument checkride as aviators who are in a nonflying status for periods between 9 and 24 months.

Both the HumRRO (1974) study and Wright's (1973) study suggest that proficiency flying programs, as currently exercised, provide little, if any, improvement in training efficiency over a schedule of non-flying that is followed by a program of retraining appropriate to an aviator's next assignment. Data from these studies also suggest that, since the skills that are likely to decay are procedural skills, most of the proficiency maintenance or retraining requirements can be met by using simulators or other training devices that are effective for training and practicing procedural skills.

A recently completed research effort by the ARI Field Unit at USAAVNC provided data that are relevant to the present research. In Phase I of this effort, Allnutt and Everhart (1980) used the UH-1 aircraft to retrain a group of 17 Individual Ready Reserve (IRR) aviators to pass a contact checkride, excluding tactical flight and instrument flight proficiency. Previous experience of the subjects ranged from 400 to 2,500 total flight hours, with a mean of 1,292 hours. Time away from flying ranged from two to nine years, with an average of six years.

The results of Phase I show that an average of about 13 flight training hours are required to retrain the aviators to criterion. Aviators with fewer total military flight hours and more years away from flying required more retraining hours to pass the checkride. The main deficiencies in flying skills observed following the non-flying period are: slow cross-check, inadequate cockpit and emergency procedures, initial over-controlling, and difficulty with emergency maneuvers--particularly autorotations with turn and simulated antitorque failures.

In Phase II of the effort, additional retraining was conducted after a three- to five-month interval of nonflying. The results of the Phase II initial checkride indicate some decay of both psychomotor skills and procedural skills during the nonflying interval. Aviators' level of proficiency after the period of nonflying was found to be positively correlated with the level of proficiency measured on the final Phase I checkride. An average of 8.5 flight hours was required to retrain aviators to a satisfactory level of proficiency.

Confidence

The majority of studies reviewed deal with the behavioral aspects of flight skill retention. One variable that may influence an aviator's performance following a period of no practice (or of limited practice) of ATM tasks is the aviator's confidence in his or her ability to perform the tasks to standards. This variable has received little attention in the literature on flight skill retention. However, casual observation indicates that a common perception in the aviation community is that an aviator's confidence is related to actual performance on a task.

In a recent study conducted at USAAVNC, Ruffner, Ciley, and Wick (1981) found a significant pretest-to-posttest increase in aviators' confidence to perform five ATM emergency tasks following a training program, without any significant pretest-to-posttest change in measured proficiency. Furthermore, confidence was not found to be correlated with actual performance. The Ruffner et al. (1981) study examined only a small, homogeneous set of ATM tasks and dealt with a relatively small sample size (n=8). A need exists to evaluate the confidence-performance relationship following a period of no practice or limited practice using a larger number of heterogeneous ATM tasks and employing a larger sample size.

Conclusions From Previous Research

A review of the literature suggests the following broad conclusions. Both psychomotor skills and procedural skills are retained to some degree after periods of nonflying and both can be relearned. However, psychomotor skills are retained better than procedural skills. Second, retention of procedural and psychomotor flying skills depends upon the level of original learning and previous experience. Third, the effects of the type of task involved and the length of the retention interval are highly specific and are likely to interact to affect retention. Finally, it is important to control/have knowledge of the type of events that occur during the retention interval in order to determine the effects of potentially interfering variables on retention.

PURPOSE AND SCOPE

The purpose of this project is to investigate the task iterations required to maintain flight proficiency in FAC 2 tasks for ARL 1 aviators. Flying hours alone are not an adequate basis upon which to define the amount of practice needed to maintain flight proficiency. For example, much flying time can be expended enroute from a base field to a stagefield with little or no practice of ATM tasks. For this reason, it is essential that proficiency maintenance requirements be defined in terms of practice iterations rather than flying hours.

There are three reasons why a full-scale evaluation of ATM task iteration requirements for all Army aircraft is not a cost effective approach for meeting the research objectives. First, there are a number of common task requirements for many of the Army's rotary wing aircraft. This commonality of tasks should permit a limited amount of generalization of results from one aircraft to another since all rotary wing flight tasks likely draw upon some common underlying skills.

Second, the cost of collecting inflight data using different Army aircraft is directly affected by the relative cost of operating each aircraft. At Fort Rucker, for example, the operating costs for the UH-1 aircraft are approximately twice the operating costs for the OH-58 aircraft, 50% of the costs for the AH-1 aircraft, and 25% of the costs for the CH-47 aircraft. Thus, cost considerations weigh heavily against the use of all aircraft.

Finally, most minimum proficiency flying currently is accomplished in the UH-1, with a lesser amount in the OH-58. The AH-1 and the CH-47 aircraft typically are flown in support of mission requirements and are seldom flown for minimum proficiency maintenance; rather, they are flown by aviators whose primary job is flying these aircraft. Maintenance of proficiency for these aviators is accomplished through continuation training in the systems/mission equipment.

The majority of FAC 2 aviators at USAAVNC and in Forces Command (FORSCOM) units use the UH-1 for proficiency maintenance. Use of this aircraft enables the results to be more directly applicable to the largest number of aviators. Therefore, the UH-1 was judged to be the most appropriate aircraft for use in research on ATM proficiency maintenance.

The research reported in this paper was undertaken as the first step in an iterative process of validation. This study is designed to systematically evaluate the FAC 2 task iteration requirements for the UH-1 aircraft. Baseline data are provided on aviator performance in the UH-1 aircraft in a six-month period of controlled amounts of flying. In addition, the relationship between aviators' confidence to perform tasks and actual performance is evaluated.

RESEARCH OBJECTIVES

The specific objectives of the research are the following:

- to determine if the minimum number of semiannual task iterations specified in the ATMs are appropriate for the maintenance of individual aviator proficiency in FAC 2 tasks,
- to identify the tasks for which changes in the iteration requirements need to be made to better achieve training effectiveness,
- to determine if previous rotary wing experience (flying hours) is related to proficiency maintenance, and
- to determine if self-rated confidence is a reliable predictor of actual flight performance.

METHOD

CONSIDERATIONS AFFECTING RESEARCH APPROACH

Two major constraints on conducting research in field units were considered in formulating an approach that addresses the research objectives in a cost-effective and timely manner. The constraints stem from the difficulty of scheduling practice and collecting data in field units.

Scheduling of Practice

Because of the requirement to maintain a combat-ready posture, it is difficult to arrange for aviators in the field to receive less than the currently required number of iterations and flying hours without adversely affecting unit readiness. It is also difficult to control the number of times each ATM task is practiced, the conditions under which it is practiced, and when it is practiced during the six-month training period.

For example, certain ATM tasks (e.g., takeoffs, straight and level flight, hovering) are essential to flying the aircraft and are practiced on every flight. Because of this, aviators complete far more than the minimum number of required iterations on these flight-essential tasks. Even if another aviator in the aircraft performs these tasks, some practice effect is likely for the aviator who is a passive passenger.

Data Collection

A review of current documents and recordkeeping practices suggests that relying on already existing data and recordkeeping practices in the field does not provide sufficient or reliable data upon which to base a validation effort. Specifically, only the minimum number of task iterations required to meet ATM standards currently are recorded in field units. Data on tasks performed in excess of the minimums are not captured for later analysis.

Performance is assessed formally by a grade of "S" or "U" (satisfactory/unsatisfactory) on two occasions: once during the commander's evaluation checkride and again during the hands-on portion of each Annual Aviator Proficiency and Readiness Test (AAPART). Performance data are not gathered frequently enough or in sufficient objective detail to provide the basis for a validation effort. Altering recordkeeping practices in the field was considered to be unfeasible. Furthermore, it is difficult to control for differences among evaluators in remote locations.

In summary, constraints on the scheduling and control of practice and on data collection in field units strongly suggest that the initial phase of the ATM validation research be conducted by utilizing a sample of aviators and a research environment that allow a greater degree of control than is possible in field units.

SUBJECTS

The subjects were selected from FAC 2 aviators assigned to staff positions at Fort Rucker. Staff aviators typically have served in one or two aviation flying positions preceding their assignment to USAAVNC and do not engage in flying activities as a regular part of their current assignment. Therefore, these individuals are good examples of aviators who are required to fly minimum iterations and hours in order to maintain flight proficiency during continuation training. Furthermore, the iteration and flying hour requirements found to be appropriate for FAC 2 aviators extend directly to FAC 1 aviators who also must maintain proficiency in FAC 2 tasks.

Aviators were selected as potential subjects if they met the following criteria: (a) scheduled to be stationed at USAAVNC through project completion, (b) not required to fly as part of their duty assignments, (c) not required to fly a minimum amount of time each month in order to qualify for flight pay, and (d) had less than 750 hours of IP time or fixed wing aircraft time.

The total number of rotary wing flight hours for the aviators who were available to participate in the research was obtained from the information copy of DA Form 759, Individual Flight Record and Flight Certificate. Of the pool of aviators meeting the above criteria, the 84 aviators with the lowest number of rotary wing flight hours were chosen as subjects. All subjects were male. Subjects were current in the UH-1 aircraft. In addition, some subjects were qualified in other rotary wing aircraft. Although it was not possible to control experimentally for previous experience, an attempt was made to obtain subjects with a sufficient range of career flight hours to permit generalization of results to other aviators.

Subjects completed a demographic questionnaire to provide additional relevant information such as age, time since flight school graduation, time at Fort Rucker, aircraft qualifications, rotary wing flight hours, fixed wing flight hours, and simulator hours. The questionnaire is included in Appendix A. Major demographic characteristics of the subjects are summarized in Table 1. Flight hour data included in the table are taken from DA Form 759 for the period prior to 1 June 1982. Total flight hours ranged from 304 to 2,874 hours. Because the distributions of flight hour data were positively skewed, the median is presented as an alternate representative measure of central tendency.

A stratified random sampling procedure was used to assign the subjects to one of seven groups. The number of rotary wing flight hours was the basis of stratification. The subject groups are summarized in Figure 1.

TABLE 1

SUMMARY OF DEMOGRAPHIC DATA

VARIABLE	MEDIAN	MEAN	SD
AGE	33.06	33.22	3.33
MONTHS SINCE FLIGHT SCHOOL GRADUATION	93.50	90.18	45.21
MONTHS SINCE ASSIGNED TO FORT RUCKER	13.70	14.04	8.62
TOTAL ROTARY WING (RW) FLIGHT HOURS	915.00	1080.25	610.48
RW HOURS LAST 12 MONTHS	42.93	57.06	56.75
RW HOURS LAST 6 MONTHS	21.10	23.54	17.23
TOTAL RW SIMULATOR HOURS	107.25	108.92	35.69
SIMULATOR HOURS LAST 12 MONTHS	19.80	19.70	9.14

Subjects in Group 1, the control group, did not fly during the six months between the initial and final checkride. Subjects assigned to Group 2 were scheduled to complete two iterations of each task approximately four months (during Practice Period I) prior to the final checkride. Subjects assigned to Group 3 were scheduled to complete two iterations approximately two months (during Practice Period II) prior to the final checkride. Subjects assigned to Groups 4 and 5 were scheduled to complete four iterations during Practice Periods I and II respectively, while subjects assigned to Groups 6 and 7 were scheduled to complete six iterations during Practice Periods I and II respectively.

The assignment of subjects to separate groups with four- and two-month retention intervals was done with the intention of using both retention interval and number of iterations as independent variables. As described below, scheduling problems precluded the use of retention interval as an independent variable in the data analyses.

GROUP	N	INITIAL CHECKRIDE	PRACTICE PERIOD I	PRACTICE PERIOD II	FINAL CHECKRIDE
1	12	IC →	6 MO. →		FC
2	12	IC →	TWO ITERATIONS	4 MO. →	FC
3	12	IC →	→	TWO ITERATIONS	2 MO. → FC
4	12	IC →	FOUR ITERATIONS	4 MO. →	FC
5	12	IC →	→	FOUR ITERATIONS	2 MO. → FC
6	12	IC →	SIX ITERATIONS	4 MO. →	FC
7	12	IC →	→	SIX ITERATIONS	2 MO. → FC
	84				

Figure 1. Subject Groups.

INSTRUCTOR PILOTS

Two Standardization Instructor Pilots (SIPs) from DES and two SIPs from the Instrument Aviator Qualification Section (IAQS) served as SIPs for the initial and final checkrides. The DES SIPs were members of the standardization team responsible for evaluating U.S. Army aviator performance worldwide. The IAQS SIPs were members of a team responsible for giving annual checkrides to staff aviators at Fort Rucker. Staff IPs from USAAVNC agencies conducted the practice iteration flights. Task performance on the checkrides and practice flights was evaluated according to ATM standards using the rating scale described below.

AIRCRAFT

All checkrides and practice flights were given in the UH-1 aircraft.

ATM TASKS

The tasks chosen for evaluation in the study, along with the current FAC 2 semiannual iteration requirements, are listed in Table 2. A detailed description of these tasks can be found in Chapter 6 of TC 1-135, Aircrew Training Manual for the Utility Helicopter (Department of the Army, 1981). The task list was limited to 48 FAC 2 contact and terrain flight tasks in order to accomplish the checkride within a three-hour flight period.

Tasks were placed in a recommended order of completion on the data collection form to facilitate use of the form by IPs on checkride and practice flights. Because of numerous considerations, such as the airfield from which the flight would depart, the stagefields available on any particular day, air traffic, weather, and time constraints, the exact order in which the tasks actually were accomplished varied for some flights.

DEPENDENT VARIABLES

Checkride Task Scores

Task performance was rated in one of two ways, depending on whether the tasks were considered to be primarily psychomotor or procedural. The classification of tasks as psychomotor or procedural was based on the distinction made by Welford (1970). Tasks were considered to be psychomotor if the overt actions involved in performing the task constituted the essential part of the task and, without which the purpose of the task would disappear. Tasks were considered to be procedural if the overt actions played a more incidental part of task performance, serving to give expression to the task rather than forming an essential part of the task.

Performance on the 33 psychomotor tasks (see Table 2) was rated by the IPs on the basis of a 12-point verbally anchored rating scale (reproduced in Figure 2). The content of the verbal descriptors was based on rating scales used by Holman (1978) and Bickley (1980) in

TABLE 2

ATM TASKS EVALUATED

TASKS		FAC 2 SEMIANNUAL ITERATIONS
FLIGHT PLANNING TASKS		
1001	**Plan a VFR Flight	4
1003	**Prepare DD Form 365F (Weight and Balance)	
1004	**Use Performance Charts	4
1005	**Prepare Performance Planning Card (PPC)	4
BEFORE FLIGHT TASKS		
1501	**Perform Preflight Inspection	3
1502	**Perform Before-Takeoff Checks	3
HOVERING TASKS		
2001	Perform Takeoff to a Hover	3
2002	**Perform Hover (Power) Checks	3
2003	Perform Hovering Turns	3
2004	Perform Hovering Flight	3
2005	Perform Landing From a Hover	3
TAKEOFF TASKS		
2501	Perform Normal Takeoff	3
2502	Perform Simulated Maximum Performance Takeoff	3
BASIC FLIGHT TASKS		
3001	Perform Straight-and-Level Flight	4
3002	Perform Climbs and Descents	4
3003	Perform Turns	4
3004	Perform Deceleration/Acceleration	4
3005	Perform Traffic Pattern Flight	3
3006	**Perform Fuel Management Procedures	4
APPROACH AND LANDING TASKS		
3501	**Perform Before-Landing Checks	3
3502	Perform Normal Approach	3
3505	Perform Steep Approach	3
3506	Perform Go-Around	2
3509	Perform High Reconnaissance	2
3510	Perform Confined Area Operations	2
3511	Perform Slope Operations	2
3512	Perform Pinnacle/Ridgeline Operations	1
EMERGENCY TASKS		
4001	Perform Hovering Autorotation	1
4002	Perform Low-Level Autorotation	1
4003	*Perform Standard Autorotation With a 180-Degree Turn	
4004	Perform Low-Level Autorotation	1
4005	Perform Simulated Hydraulic System Malfunction	2
4006	Perform Simulated Antitorque	2
4007	Perform Manual Throttle Operation, Emergency Governor Mode	1
4008	Perform Simulated Engine Failure at Altitude	2
4009	Perform Simulated Engine Failure from Hover Altitude	2
4019	Perform Shallow Approach to a Running Landing	2
INSTRUMENT FLIGHT TASKS		
4506	**Perform Radio Communications Procedure	4
TACTICAL AND SPECIAL TASKS		
5001	**Perform Terrain Flight Mission Planning	2
5002	**Perform Terrain Flight Navigation	2
5003	Perform Low-Level Flight	2
5005	Perform NOE Flight	2
5007	Perform NOE Deceleration	2
5008	**Perform Hover Out-of-Ground Effect (OGE) Check	2
5009	Perform Terrain Flight Takeoff	2
5010	Perform Terrain Flight Approach	2
AFTER LANDING TASKS		
6501	**Perform After-Landing Tasks	3

Note. Task numbers, categories, and names are those listed in TC 1-135, Utility Helicopter ATM.

*Deleted from task list.
**Procedural tasks.

RATING	DESCRIPTION
1	Performance unsafe to the extent that the IP immediately had to take control of the aircraft.
2	Performance deteriorated until IP was finally required to take control of the aircraft.
3	Few of the ATM standards were met, student required considerable verbal assistance, but IP did not have to take control of the aircraft.
4	Less than half of the ATM standards were met, student required some verbal assistance and continually over/under controlled.
5	Less than half of the ATM standards were met, required little verbal assistance, but frequently over/under controlled.
6	Majority of the ATM standards were met, student required little or no verbal assistance, but tended to occasionally over-control or accepted slight deviations while attempting corrections.
7	Majority of the ATM standards were met, little or no verbal assistance needed, performance generally smooth but occasionally over-controlled or was slow making necessary corrections.
8	All ATM standards were met, most deviations from desired state were quickly noticed and smoothly corrected.
9	All ATM standards were met, all deviations from desired state were immediately noticed and smoothly corrected.
10	All ATM standards were met. Majority of performance within IP standards.
11	All performance within IP standards, any deviations from desired state were small and immediately corrected.
12	Outstanding. No noticeable deviations from desired performance.

Figure 2. Task rating scale.

research evaluating simulator-to-aircraft transfer of training. The scale was modified on the basis of recommendations by IPs who regularly evaluate aviators' performance in continuation training. The verbal anchors included in the scale are statements describing pilot behavior along such dimensions as the amount of under- or over-controlling of the aircraft, the amount of verbal assistance required from the IP, and the percentage of ATM standards met.

In addition to the 1-12 numerical rating, IPs noted deviations from desired standards for the 33 psychomotor tasks by marking one of two categories for each standard. For example, a deviation from desired altitude was indicated as either LO or HI. These data were retained for later analysis.

Fourteen of the tasks were procedural (step-following) tasks (see Table 2). For these tasks, the IP marked the number of omissions or mistakes made by the subject. The numerical score on the procedural tasks was obtained by subtracting the number of omissions marked from an arbitrary maximum score of 9. Paper-and-pencil academic tests were developed by the DES SIPs to assess knowledge in the following procedural tasks:

- Plan a VFR Flight,
- Prepare a Weight and Balance Form,
- Use Performance Charts,
- Prepare a Performance Planning Card (PPC), and
- Perform Fuel Management Procedures.

Academic tests were scored in the same manner as the other procedural tasks. Copies of the academic tests and reference material that were used by the aviators are included in Appendix B. A copy of the checkride data collection form is given in Appendix C.

Confidence Ratings

Confidence to perform each task to ATM standards was measured by using the same scale employed by Ruffner et al. (1981). Subjects placed a slash through a 100 mm line anchored at the left and right end-points with the verbal descriptors "Low Confidence" and "High Confidence," respectively. The resultant confidence score was calculated as the distance, in millimeters, from the left end-point to the subject's mark. The confidence rating form is shown in Appendix D.

PROCEDURE

Initial Checkrides

The initial checkrides began during the second week of June 1982. Up to six test subjects were scheduled each day, three in the morning and three in the afternoon, depending on IP availability.

Subjects indicated their confidence to perform each of the tasks to ATM standards, both before and after the initial checkride. Subjects filled out the confidence rating form and completed the academic test portion of the initial checkride prior to beginning the inflight portion of the checkride. On a few occasions, subjects completed part or all of the academic tests following the flight. From 2 to 2.5 hours were required to complete the checkrides.

During the weeks designated for the initial checkrides, several flights had to be rescheduled because of bad weather, maintenance problems, or unavailability of IPs. In some cases, a second flight for the initial checkride had to be scheduled to evaluate tasks not completed during the first flight that was shortened because of weather or maintenance problems. There was insufficient time to evaluate two of the test subjects on the eight terrain flight tasks.

Of the 81 initial checkrides, 56 were given by SIPs from DES and 16 were given by SIPs from IAQS. Because one of the IAQS SIPs was not available for one week of the initial checkrides, eight checkrides were given by IPs from ARI and Anacapa Sciences, and one checkride was given by an IP from the U.S. Army Aeromedical Center.

Practice Iterations

Practice iteration flights began during the third week in July, 1982 and ended during the second week in November, 1982. A practice iteration was operationally defined as one attempt by the subject to perform a task per flight. On a few occasions, a task not completed on a preceding flight was practiced more than one time on a subsequent flight. The following procedures were adopted to standardize the practice flights and to increase the likelihood that the test subjects would be able to practice entire tasks:

- Subjects completed special Weight and Balance exercises constructed by the DES SIPs prior to each flight. Copies of these exercises are given in Appendix E.

- IPs demonstrated the Antitorque Failure (Left and Right Pedal) tasks once prior to the subjects performing the tasks. The IPs also established the entry point for the Standard Autorotation task.

- Except for Antitorque Failures and Standard Autorotations, all tasks were performed by the subjects without IP demonstration or prior instruction.

- IPs gave the subjects constructive feedback after each task if the task was performed below the satisfactory level or if feedback was requested by the subject.

- Psychomotor and procedural tasks were evaluated by the staff IPs in the same manner as in the initial and final checkrides. The rating data for the practice flights were retained for later analyses.

An instruction sheet listing these procedures was attached to the front of the data collection form. The procedures were briefed to the staff IPs conducting the practice flights.

Final Checkrides

The final checkrides began during the third week in November 1982. To keep the interval between the initial and final checkrides about the same, subjects were scheduled to take the final checkride in approximately the same order in which they had completed the initial checkride.

The final checkrides were conducted in the same manner as the initial checkrides. Both the subjects and the IPs were instructed prior to the flight not to discuss the number of iterations the subjects had been given during the practice periods or the subjects' flight hours to avoid contaminating the IPs' evaluation of checkride performance. The academic tests were completed by the subjects following the inflight portion of the checkride in order to minimize interference with airspace and stagefield usage.

As in the initial checkride, confidence ratings were completed both before and after the final checkrides. Following the completion of the post-checkride confidence rating, IPs debriefed the test subjects on their flight performance.

RESULTS

CHECKRIDE SCORES

Analysis of Variance

A one-way analysis of variance (ANOVA) was performed using the number of total flight hours as the dependent variable and the group to which subjects were assigned as the independent variable. The effect of group assignment was not significant (F (6,74) = .14, p < .05), indicating that subjects were randomly assigned to groups with respect to total flight hours.

Three of the 84 subjects discontinued participation in the study before they were able to take the initial checkride. Of the three subjects, one was transferred from Fort Rucker; one was withdrawn from the study by his superior due to conflicting duty requirements; and one was unavoidably sent on an extended temporary duty (TDY) assignment and was unable to return in time to take the initial checkride. A total of 81 subjects took the initial checkride.

Seventy-nine of the 81 subjects who took the initial checkride were able to complete the final checkride. One subject was removed from flying status midway through the study. Another subject was medically grounded and was unable to take the final checkride. Therefore, final checkride data were not available for these subjects. Seventy of the 79 final checkrides were given by the same IP who gave the subject's initial checkride. The nine checkrides not given by the same IP were nonsystematically distributed across the seven subject groups.

Means and standard deviations for the initial and final checkride raw scores are presented in Table 3. To permit the use of parametric statistical analyses, initial and final checkride raw data were transformed to normalized data following a method outlined by Hays (1967). Scores were normalized separately for each IP across initial and final checkrides. The normalization procedure is described in detail in Appendix F.

It became apparent during the first two weeks of practice flights that staff IPs would not be available as often as anticipated. This made it impossible to keep retention intervals of two- and four-months as originally planned. Therefore, inclusion of retention interval as a dichotomous independent variable was no longer practical. Instead, the data were analyzed using normalized final checkride scores as the dependent variable, with iteration groups and flight hour groups as independent variables.

For purposes of data analysis, subjects were placed in one of four iteration groups for each task. The first group consisted of the control group. The other three groups consisted of subjects who had completed two, four, or six iterations in a particular task, collapsing over practice periods. Subjects were also divided into two flight hour groups. The high flight hour group was composed of subjects with more than 900 total rotary wing hours; the low flight hour group was composed of subjects with less than 900 total rotary wing hours. Since the median number of flight hours was 915, this resulted in approximately the same number of subjects in both flight hour groups.

TABLE 3

MEANS AND STANDARD DEVIATIONS
FOR INITIAL AND FINAL CHECKRIDE RAW SCORES*

ATM TASK	INITIAL CHECKRIDE		FINAL CHECKRIDE	
	M	SD	M	SD
1. Plan VFR Flight	7.05	1.58	7.64	1.20
2. Weight and Balance Form	4.47	1.87	6.17	2.04
3. Use Performance Charts	7.47	1.59	8.14	1.20
4. Prepare Performance Planning Card (PPC)	7.20	1.60	8.06	1.04
5. Fuel Management	7.73	1.39	7.96	1.18
6. Preflight Inspection	8.63	.78	8.41	.52
7. Before Takeoff Checks	8.65	.66	8.08	1.17
8. Communications Procedures	8.35	1.04	8.36	.64
9. After Landing Tasks	7.68	1.80	7.69	.96
10. Takeoff to Hover	8.04	1.10	8.06	.78
11. Hover Check	8.00	1.25	8.06	.94
12. Hover Turn	8.32	.93	8.20	.49
13. Hover Flight	8.54	.94	8.23	.48
14. Landing from Hover	8.03	.93	8.08	.75
15. Manual Throttle Operation	6.78	1.60	6.58	1.62
16. Engine Failure at Hover	7.44	1.36	7.55	1.02
17. Hovering Autorotation	7.68	1.22	7.65	.92
18. Slope Operations	7.56	1.52	7.81	.74
19. Traffic Pattern	7.71	1.21	8.09	.74
20. Climb/Descend	7.88	1.01	8.15	.51
21. Turns	7.87	1.04	8.17	.59
22. Straight-and-Level Flight	8.19	.87	8.06	.78
23. Normal Takeoff	7.90	1.10	8.01	.75
24. Maximum Performance Takeoff	7.45	1.21	7.55	1.04
25. Before Landing Checks	7.58	1.86	7.60	1.40
26. Normal Approach	7.68	1.13	7.89	.72
27. Steep Approach	7.47	1.15	7.63	.85
28. Shallow Approach Running Landing	7.68	1.25	7.92	.96
29. Hydraulic Failure	7.18	1.54	6.89	1.83
30. Antitorque Failure - Left	5.32	2.44	6.30	1.94
31. Antitorque Failure - Right	5.59	2.32	6.18	1.94
32. Go Around	8.00	1.14	8.17	.61
33. Standard Autorotation	6.22	2.07	6.59	1.78
34. Low Level Autorotation	6.50	1.53	6.82	1.66
36. Deceleration/Acceleration	7.92	1.07	7.91	.91
37. Engine Failure at Altitude	7.50	1.69	7.83	1.00
38. High Reconnaissance	7.74	1.29	8.23	.68
39. Confined Area Operations	7.49	1.40	8.05	.85
40. Pinnacle/Ridgeline Operations	7.51	1.84	7.76	1.14
41. Terrain Flight Mission Planning	7.92	1.28	8.33	.53
42. Terrain Flight Navigation	7.48	1.99	8.05	1.22
43. Low-Level Flight	8.12	1.09	8.26	.73
44. NOE Flight	7.97	1.30	8.20	.76
45. NOE Deceleration	7.25	1.54	7.59	1.22
46. Terrain Flight Approach	7.71	1.45	8.26	.73
47. Out-of-Ground Effect Check	6.99	1.90	7.69	1.51
48. Terrain Flight Takeoff	7.58	1.38	8.08	.88

*N = 73

The initial checkride scores of one of the subjects in the control group were highly deviant from the rest of the group. Since including this subject's data would bias the statistical analysis, the subject's data were not used in the analysis of checkride scores. The data from five subjects who did not complete the scheduled number of iterations (i.e., 0, 2, 4, or 6) were not included in the analysis of variance. This resulted in a final sample size of 73 aviators for the analysis of variance. Missing values were estimated by the BMDP AM statistical program (Engelman, Frane, & Jennrich, 1977).

The task Perform Standard Autorotation with 180° Turn was removed as an ATM task during the research. Accordingly, it was deleted from the task list and not evaluated on the final checkride. This reduced the total number of tasks to 47.

Initial checkride normalized scores were used as dependent variables in a 2 (Flight Hour groups) x 4 (Iterations) x 47 (Tasks) ANOVA to determine if there were significant pre-treatment differences among the two Flight Hour Groups or among the four Iteration groups. Tasks were used as a within-subjects variable. The ANOVA was performed using the BMDP 2V repeated-measures program. No significant differences were found between Flight Hour groups ($\underline{F}$ (1,65) = 2.29, $\underline{p}$ <.05), among Iteration groups ($\underline{F}$ (3,65) = 1.41, $\underline{p}$ <.05), or for the Flight Hour x Iteration interaction ($\underline{F}$ (3,65) = .54, $\underline{p}$ <.05).

Normalized checkride scores for the 47 tasks were used as data in a 2 (Flight Hour group) x 4 (Iterations) x 47 (Tasks) x 2 (Initial Checkride Pretest-Final Checkride Posttest) ANOVA with repeated measures on the last two factors. The ANOVA was performed using the BMDP 2V statistical program. The results of the ANOVA are summarized in Table 4. Significant main effects were found for the independent variables of Flight Hours ($\underline{p}$ <.05) and Tasks ($\underline{p}$ <.01). Significant two-way interactions were found for Tasks x Flight Hours ($\underline{p}$ <.01), Tasks x Iterations ($\underline{p}$ <.05) and Pre-Post x Tasks ($\underline{p}$ <.01). None of the higher order interactions reached statistical significance ($\underline{p}$ <.05).

The amount of variance accounted for (ω^2) was also estimated for each main effect and interaction and is included in Table 4. Examination of the ω^2 values (Dwyer, 1974) indicates that a minimum of one percent of the total variance was accounted for by only two sources--the main effects of Tasks and the interaction of Pre-Post x Tasks. A Tukey HSD test for pairwise comparisons (Kirk, 1968) indicated that mean final checkride scores were significantly greater than mean initial checkride scores for the following tasks: Plan VFR Flight, Prepare Weight and Balance Form, Use Performance Charts, Prepare Performance Planning Card, Perform Terrain Flight Approach, and Perform Out-of-Ground Effect Check. Mean final checkride score was significantly less than mean initial checkride score for the task Perform Before Takeoff Checks.

Raw score means for the four iteration groups for the initial and final checkrides are graphically presented in Appendix G. The graphs in Appendix G illustrate the average increase or decrease in mean proficiency score from the initial checkride to final checkride. The

Table 4

ANOVA Summary Table for Normalized Checkride Ratings

Source of Variance	SS	df	MS	F	ω^2
Between Subjects					
Flight Hours (FH)	42.44	1	42.44	5.26*	.006
Iterations (I)	14.73	3	4.91	.61	.000
FH x I	8.96	3	2.99	.37	.000
Error	524.82	65	8.07		.086
Within Subjects					
Pre-Post (P)	22.85	1	22.85	3.25	.003
P x FH	0.00	1	0.00	0.00	.000
P x I	49.34	3	16.45	2.34	.005
P x FH x I	7.52	3	2.51	.36	.000
Error	456.43	65	7.02		.075
Tasks (T)	1039.94	46	22.61	41.01**	.169
T x FH	37.35	46	.81	1.47*	.002
T x I	97.19	138	.70	1.28*	.004
T x FH x I	69.79	138	.51	.92	.000
Error	1648.25	2990	.55		.270
P x T	82.47	46	1.79	4.13**	.010
P x T x FH	14.40	46	.31	.72	.000
P x T x I	67.21	138	.49	1.12	.001
P x T x FH x I	51.96	138	.38	.87	.000
Error	1299.46	2990	.43		.435

Note. *p <.05
**p <.01

satisfactory proficiency level of 8 (all ATM standards met) is noted by a dashed horizontal line. Raw score means and standard deviations for the four iteration groups are given in Table 5 for the total sample as well as for the two flight-hour groups. Means are rounded to the nearest whole number. Average proficiency was below 8 on both the initial and final checkrides for four tasks. Three of the four tasks are emergency tasks.

The correlation between overall initial checkride performance and overall final checkride performance for the 0 iteration group was calculated as an indication of the relationship between initial level of performance and level of performance following six months of no practice. A composite score (average of all 47 task scores) was used as an estimate of the overall level of performance for each subject, since the single overall rating was not obtained. Composite scores were calculated separately for both the initial checkride and the final checkride. The correlation between overall initial checkride performance and overall final checkride performance is .42 ($df = 9$, $p < .20$).

Correlations among total rotary wing flight hours, recent flight hours (within the last 12 and 6 months), and initial checkride normalized scores are presented in Table 6. The correlations of the flight hour variables and final checkride normalized scores are presented in Table 7. Retention interval (number of days between the completion of the last practice flight and the final checkride) was negatively correlated with five tasks and positively correlated with one task. No significant correlations were found between checkride performance and the variables of age, months since flight school graduation, and total simulator hours.

Factor Analysis

Means, standard deviations, correlations of final checkride normalized scores with the final checkride composite scores, and intercorrelations for the final checkride normalized scores are given in Appendix H. Examination of the correlation matrix indicated that several groups of tasks had high intercorrelations. Therefore, a principal factors extraction with varimax rotation was performed on the final checkride normalized scores.

Six factors emerged that had eigenvalues greater than 1.0 and that had a minimum of four tasks with factor loadings of .45 (20% of shared variance) or greater (Comrey, 1973). These factors were initially rotated to an orthogonal solution. Factor loadings, communalities, eigenvalues, and percentages of common variance for the six factor solutions are given in Table 8. Tasks are grouped under the factor for which they show the highest significant loading and are listed in decreasing order of loadings for that factor. Table 8 indicates that tasks generally load high on one factor and low on the other factors. In only a few cases do tasks have sizable loadings on more than one factor.

TABLE 5

MEANS AND STANDARD DEVIATIONS FOR CHECKRIDE RAW SCORES:
AVIATORS WITH MORE THAN 900 HOURS

	ITERATIONS															
	0 (N = 5)				2 (N = 11)				4 (N = 12)				6 (N = 9)			
	Initial		Final		Initial		Final		Initial		Final		Initial		Final	
ATM TASK	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
1. Plan VFR Flight	6	1.9	7	1.5	7	1.9	8	1.4	7	.9	8	1.3	7	1.3	8	1.4
2. Weight and Balance Form	4	1.1	5	.9	5	1.8	6	1.6	5	2.3	7	2.1	4	2.4	7	1.5
3. Use Performance Charts	7	1.6	7	2.5	7	1.6	9	.7	7	2.0	8	1.6	7	1.8	8	.9
4. Prepare PPC	7	1.6	8	.8	7	1.6	9	.7	7	1.8	8	1.6	7	1.7	8	.9
5. Fuel Management	8	1.3	8	1.1	8	1.0	8	1.2	7	2.3	8	1.5	8	.9	7	1.2
6. Preflight Inspection	9	.0	9	.5	9	.8	8	.7	8	1.2	9	.5	9	.4	8	.5
7. Before Takeoff Checks	9	.4	9	.5	9	.9	7	2.4	9	.9	9	.7	9	.4	8	.7
8. Communications Procedures	9	.4	8	.5	8	1.2	8	.7	8	1.1	9	.5	9	.4	9	.5
9. After Landing Tasks	8	1.2	8	.8	8	1.9	8	1.3	8	1.7	8	1.0	8	.9	8	.6
10. Takeoff to Hover	8	1.7	9	.5	8	1.3	8	.7	8	1.2	8	.8	9	.9	8	.5
11. Hover Check	9	.9	9	.5	8	1.3	7	1.4	8	1.3	8	.5	8	1.5	8	.5
12. Hover Turn	9	.5	9	.5	8	1.0	8	.5	8	1.0	8	.5	9	.9	8	.5
13. Hover Flight	8	1.3	9	.5	8	1.1	8	.3	8	1.2	8	.6	9	.9	8	.5
14. Landing from Hover	8	1.3	9	.5	8	1.0	8	.4	8	1.0	8	.5	8	.9	8	.5
15. Manual Throttle Operation	8	1.5	6	2.2	7	1.6	7	.9	6	1.6	7	1.8	7	1.9	6	1.8
16. Engine Failure at Hover	8	1.6	8	1.2	8	1.1	8	.5	8	1.4	8	.9	7	1.6	8	1.0
17. Hovering Autorotation	8	1.5	7	2.0	8	1.2	8	.6	8	1.3	8	.8	8	1.6	8	1.0
18. Slope Operations	8	1.4	8	.6	8	1.5	8	.8	8	1.1	8	.5	8	1.9	8	.3
19. Traffic Pattern	8	1.7	8	.9	8	1.2	8	.6	8	.9	9	.5	8	.8	8	1.0
20. Climb/Descend	8	1.3	9	.5	8	1.1	8	.3	8	.9	9	.5	8	.9	8	.7
21. Turns	8	.9	9	.5	9	1.0	8	.3	8	.9	9	.5	8	.9	8	.8
22. Straight and Level Flight	9	.8	8	.9	8	1.1	8	1.0	8	.7	9	.7	8	.7	8	.8
23. Normal Takeoff	8	1.7	8	.9	8	1.1	8	.6	8	1.2	8	.7	8	1.1	8	.9
24. Max. Performance Takeoff	8	.9	8	1.2	7	1.6	7	1.3	8	1.1	8	1.1	8	1.1	8	.5
25. Before Landing Checks	7	2.5	8	.7	7	2.6	7	2.3	8	.8	8	1.1	8	1.5	8	.5
26. Normal Approach	8	.9	8	.8	8	1.3	8	.5	8	1.2	8	.8	7	1.0	8	.4
27. Steep Approach	8	1.7	8	.8	7	1.1	8	.8	7	1.2	8	.9	7	1.0	8	1.1
28. Shallow App Running Land	8	2.0	8	.5	8	1.3	8	.9	8	1.4	8	.8	7	1.1	8	.9
29. Hydraulic Failure	8	1.6	8	.5	7	1.8	7	1.5	8	.9	8	.8	6	1.9	7	1.7
30. Antitorque Failure - Left	5	3.4	6	3.0	6	2.4	7	1.8	6	2.1	7	1.5	6	1.7	6	1.1
31. Antitorque Failure - Right	6	2.3	6	3.1	6	2.5	7	1.7	6	2.0	7	2.0	6	2.0	7	.8
32. Go Around	9	.5	8	.8	8	1.1	8	.5	8	1.0	8	.5	9	1.0	8	.8
33. Standard Autorotation	7	2.5	8	.8	8	2.1	8	1.3	6	2.1	6	1.9	6	1.2	6	1.0
34. Low Level Autorotation	7	1.5	7	2.9	7	1.3	7	1.8	6	1.8	7	1.6	8	1.2	7	1.2
*																
36. Decel/Accel	8	1.4	8	1.1	8	1.3	8	.9	8	1.2	8	1.0	8	.5	8	.8
37. Engine Failure at Altitude	8	.9	8	.9	8	1.9	8	.6	7	1.6	8	.9	8	1.5	8	1.4
38. High Reconnaissance	9	.4	9	.5	8	1.7	8	.5	8	1.1	8	1.1	8	1.5	8	.5
39. Confined Area Operations	9	.5	8	.5	7	1.9	8	.9	8	1.4	8	.9	8	1.6	8	1.0
40. Pinnacle/Ridgeline Operations	9	.5	8	.8	8	2.3	8	.7	7	1.3	8	1.1	7	2.0	8	.4
41. Ter. Flight Mission Planning	8	1.2	8	.8	7	2.2	8	.5	8	1.2	9	.5	8	1.0	8	.5
42. Ter. Flight Navigation	7	2.7	7	2.0	7	2.6	8	.9	8	1.2	8	.7	8	1.0	8	.4
43. Low-Level Flight	9	.8	9	.5	8	1.5	8	.6	8	1.0	9	.5	8	.7	8	.9
44. NOE Flight	8	1.5	9	.5	8	2.0	8	.7	8	1.2	9	.5	8	.7	8	.4
45. NOE Deceleration	8	1.4	8	.8	8	1.5	8	2.0	8	1.4	8	1.0	8	1.4	8	1.1
46. Ter. Flight Approach	8	1.2	8	.8	8	1.1	8	.5	8	1.4	8	.7	8	.7	8	.5
47. OGE Check	7	2.2	8	1.6	7	2.0	8	.9	7	1.9	8	.7	7	2.4	8	1.0
48. Ter. Flight Takeoff	8	1.4	8	1.3	7	1.9	8	.9	8	1.1	8	.7	8	.8	8	.7

*Note. Task 35, Standard Autorotation with 180° Turn, was deleted from the task list.

TABLE 5 (CONTINUED)

MEANS AND STANDARD DEVIATIONS FOR CHECKRIDE RAW SCORES:
AVIATORS WITH LESS THAN 900 HOURS

	ITERATIONS															
	0 (N = 6)				2 (N = 11)				4 (N = 11)				6 (N = 8)			
	Initial		Final		Initial		Final		Initial		Final		Initial		Final	
ATM TASK	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
1. Plan VFR Flight	7	1.6	8	.5	7	1.0	8	.9	6	2.2	8	1.1	8	.9	8	.7
2. Weight and Balance Form	4	1.3	4	.4	4	1.4	6	1.9	4	1.8	6	2.2	4	1.8	7	2.2
3. Use Performance Charts	9	.5	8	1.9	7	1.6	8	.8	8	.9	9	.5	8	2.0	8	.5
4. Prepare PPC	8	1.2	8	1.8	7	1.4	8	.8	7	1.2	8	.9	7	1.9	8	.4
5. Fuel Management	8	.8	7	1.5	8	1.3	8	1.0	8	1.2	8	1.0	7	1.5	8	.7
6. Preflight Inspection	9	.4	8	.5	9	.9	8	.5	9	.5	8	.5	9	.7	8	.5
7. Before Takeoff Checks	9	.4	8	.5	9	.5	8	1.1	9	.5	8	.5	9	.7	8	.6
8. Communications Procedures	9	.8	8	1.1	8	1.1	9	.5	8	.7	8	.5	9	1.1	8	.9
9. After Landing Tasks	8	1.0	8	1.2	7	2.5	7	1.1	8	1.6	8	.6	8	1.4	8	.9
10. Takeoff to Hover	9	.8	8	.6	8	1.1	8	1.4	8	1.0	8	.7	8	1.0	8	.5
11. Hover Check	9	.8	8	1.4	8	1.1	8	1.1	8	1.2	8	.6	8	1.9	8	.5
12. Hover Turn	9	.8	8	.4	8	1.0	8	.8	8	.9	8	.3	8	1.0	8	.0
13. Hover Flight	9	.8	8	.4	8	.8	8	.5	9	.7	8	.4	8	1.0	8	.5
14. Landing from Hover	8	1.8	8	.4	8	.8	8	1.7	8	.6	8	.3	8	.9	8	.4
15. Manual Throttle Operation	6	1.7	6	1.2	7	1.9	7	1.6	7	1.1	6	1.8	6	1.2	6	1.8
16. Engine Failure at Hover	8	1.0	8	1.0	7	.9	7	1.7	7	1.7	7	.8	8	1.6	8	.8
17. Hovering Autorotation	8	1.0	7	.9	7	1.0	8	.6	7	1.3	8	.7	8	1.0	8	.8
18. Slope Operations	8	1.2	8	.8	7	1.2	8	.8	8	1.3	8	1.3	6	2.5	8	.5
19. Traffic Pattern	8	.8	8	.8	7	.9	8	.5	7	1.7	8	.5	8	1.2	8	.9
20. Climb/Descend	8	.9	8	.4	8	1.0	8	.5	8	.9	8	.5	8	1.3	8	.4
21. Turns	8	.8	8	.6	8	.9	8	.6	8	1.3	8	.8	7	1.3	8	.4
22. Straight and Level Flight	9	.5	8	1.0	8	1.1	8	.6	8	.5	8	.6	8	.9	8	.7
23. Normal Takeoff	8	.6	8	1.0	8	1.1	8	.8	8	.8	8	.4	8	1.2	7	.9
24. Max. Performance Takeoff	8	1.5	7	1.2	7	1.2	8	.9	7	1.0	7	1.4	7	1.1	8	.5
25. Before Landing Checks	8	1.3	8	1.0	7	2.4	8	.8	8	1.3	7	2.0	8	1.1	8	1.0
26. Normal Approach	8	.8	8	.4	7	1.1	8	.9	8	1.0	8	.5	7	1.2	8	.8
27. Steep Approach	8	.8	7	.5	7	1.3	8	1.1	8	1.0	8	.4	7	1.1	7	1.0
28. Shallow App Running Land	9	.8	7	1.3	8	1.0	8	1.2	7	1.2	8	.9	7	1.5	8	1.0
29. Hydraulic Failure	8	.5	7	1.5	8	.8	7	2.3	7	1.6	5	2.3	6	2.4	7	.7
30. Antitorque Failure - Left	6	2.2	6	2.5	6	2.9	6	2.0	5	2.3	5	2.0	4	2.4	6	1.4
31. Antitorque Failure - Right	6	2.5	5	2.1	5	2.7	6	2.2	6	2.3	6	2.0	4	2.7	6	2.0
32. Go Around	9	.5	8	.5	8	1.1	8	.4	8	1.7	8	.8	8	1.5	9	.6
33. Standard Autorotation	8	.8	6	1.9	6	1.1	6	2.2	5	2.2	6	1.6	5	2.7	7	1.8
34. Low Level Autorotation	7	.8	6	2.6	7	1.0	7	1.6	6	2.1	7	1.0	7	1.5	6	1.1
*																
36. Decel/Accel	8	.8	8	1.0	8	.8	8	.8	8	1.1	8	.9	8	1.2	8	1.0
37. Engine Failure at Altitude	8	1.9	7	.8	7	1.3	8	.7	7	2.0	7	1.3	6	2.3	8	.7
38. High Reconnaissance	8	1.3	8	.6	7	1.1	8	.7	8	.9	8	.6	8	2.1	8	.4
39. Confined Area Operations	8	1.0	8	1.4	7	1.5	8	.9	7	1.0	8	.8	7	1.5	8	.9
40. Pinnacle/Ridgeline Operations	8	1.0	7	1.9	7	2.4	7	1.9	8	.8	8	.8	9	.6	7	1.2
41. Ter. Flight Mission Planning	8	1.0	8	.5	8	1.3	8	.5	8	1.1	8	.4	8	1.1	8	.5
42. Ter. Flight Navigation	8	1.1	7	2.0	7	1.2	8	2.2	7	2.0	8	.3	7	3.1	8	.5
43. Low-Level Flight	8	1.0	8	1.2	8	1.1	8	.5	8	1.3	8	.8	8	1.1	8	.9
44. NOE Flight	8	1.1	8	1.7	8	1.2	8	.5	8	1.6	8	.6	8	1.0	8	.8
45. NOE Deceleration	7	1.2	8	.7	7	1.3	8	1.4	6	2.1	7	1.3	7	2.0	7	.9
46. Ter. Flight Approach	8	1.1	8	1.7	8	1.5	9	.5	7	2.2	8	.5	8	1.2	8	.6
47. OGE Check	7	1.3	8	1.1	7	1.5	7	1.8	7	2.3	7	1.1	7	2.3	7	2.6
48. Ter. Flight Takeoff	8	.9	8	1.1	8	1.5	8	.9	7	1.4	8	.6	7	1.8	8	1.3

*Note. Task 35, Standard Autorotation with 180° Turn, was deleted from the task list.

TABLE 5 (CONTINUED)

MEANS AND STANDARD DEVIATIONS FOR CHECKRIDE RAW SCORES: ALL AVIATORS

	ITERATIONS															
	0 (N = 11)				2 (N = 22)				4 (N = 23)				6 (N = 17)			
	Initial		Final		Initial		Final		Initial		Final		Initial		Final	
ATM TASK	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
1. Plan VFR Flight	7	1.9	8	1.0	7	1.5	8	1.1	7	1.7	8	1.2	8	1.2	8	1.1
2. Weight and Balance Form	4	1.2	4	.7	4	1.6	6	1.7	5	2.1	7	2.2	4	2.1	7	1.8
3. Use Performance Charts	8	1.3	8	2.1	7	1.6	8	.7	7	1.6	8	1.3	7	1.8	8	.7
4. Prepare PPC	8	1.4	8	1.4	7	1.5	8	.7	7	1.6	8	1.3	7	1.7	8	.7
5. Fuel Management	8	1.0	7	1.3	8	1.2	8	1.1	7	1.8	8	1.3	8	1.3	8	1.1
6. Preflight Inspection	9	.3	8	.5	9	.9	8	.6	8	.9	8	.5	9	.6	8	.5
7. Before Takeoff Checks	9	.4	8	.5	9	.7	8	1.9	9	.7	8	.7	9	.6	8	.7
8. Communications Procedures	9	.7	8	.9	8	1.1	8	.6	8	.9	9	.5	9	.8	8	.8
9. After Landing Tasks	8	1.0	8	1.0	7	2.3	8	1.2	8	1.6	8	.9	8	1.2	8	.7
10. Takeoff to Hover	8	1.3	8	.6	8	1.2	8	1.1	8	1.1	8	.7	8	1.0	8	.6
11. Hover Check	9	.8	8	1.1	8	1.2	8	1.3	8	1.2	8	.6	8	1.7	8	.5
12. Hover Turn	9	.7	8	.5	8	1.0	8	.7	8	.9	8	.4	8	.9	8	.4
13. Hover Flight	8	1.0	8	.5	8	.9	8	.4	8	1.0	8	.5	8	.9	8	.5
14. Landing from Hover	8	1.0	8	.6	8	.9	8	1.2	8	.8	8	.4	8	1.0	8	.5
15. Manual Throttle Operation	7	1.9	6	1.7	7	1.7	7	1.3	7	1.4	6	1.8	6	1.6	6	1.8
16. Engine Failure at Hover	8	1.3	8	1.1	8	1.0	8	1.3	7	1.6	8	.9	7	1.5	8	.9
17. Hovering Autorotation	8	1.2	7	1.5	8	1.1	8	.6	8	1.3	8	.8	8	1.3	8	.9
18. Slope Operations	8	1.3	8	.7	7	1.3	8	.8	8	1.2	8	1.0	7	2.3	8	.4
19. Traffic Pattern	8	1.2	8	.8	8	1.1	8	.6	8	1.4	8	.5	8	1.0	8	1.0
20. Climb/Descend	8	1.0	8	.5	8	1.1	8	.4	8	.9	8	.6	8	1.1	8	.6
21. Turns	8	.8	8	.6	8	1.0	8	.5	8	1.1	8	.7	8	1.1	8	.6
22. Straight and Level Flight	9	.6	8	1.0	8	1.1	8	.8	8	.7	8	.6	6	.8	8	.8
23. Normal Takeoff	8	1.2	8	1.0	8	1.1	8	.7	8	1.0	8	.6	8	1.1	8	.9
24. Max. Performance Takeoff	8	1.2	7	1.2	7	1.4	8	1.1	7	1.1	7	1.3	7	1.2	8	.5
25. Before Landing Checks	8	1.8	8	.9	7	2.4	7	1.7	8	1.1	8	1.6	8	1.3	8	.7
26. Normal Approach	8	.8	8	.6	8	1.2	8	.8	8	1.1	8	.7	7	1.1	8	.7
27. Steep Approach	8	1.2	8	.7	7	1.2	8	1.0	8	1.1	8	.7	7	1.1	8	1.1
28. Shallow App Running Landing	8	1.1	8	1.2	8	1.1	8	1.0	8	1.3	8	.9	7	1.3	8	.9
29. Hydraulic Failure	8	1.1	7	1.5	7	1.4	7	1.9	7	1.3	7	2.0	6	2.1	7	1.3
30. Antitorque Failure - Left	5	2.7	6	2.6	6	2.6	7	2.0	6	2.1	6	2.1	5	2.2	6	1.2
31. Antitorque Failure - Right	6	2.3	6	2.5	6	2.6	6	2.0	6	2.1	6	2.0	5	2.5	6	1.5
32. Go Around	9	1.5	8	.7	8	1.1	8	.5	8	1.4	8	.7	8	1.1	8	.8
33. Standard Autorotation	7	1.8	7	1.7	7	1.7	7	1.9	5	2.2	6	1.7	6	2.1	7	1.4
34. Low Level Autorotation	7	1.2	6	2.7	7	1.2	7	1.6	6	1.9	7	1.3	7	1.3	7	1.2
*																
36. Decel/Accel	8	1.0	8	1.0	8	1.0	8	.8	8	1.1	8	.9	8	.9	8	.9
37. Engine Failure at Altitude	8	1.5	8	1.0	8	1.6	8	.7	7	1.8	7	1.2	7	1.9	8	1.2
38. High Reconnaissance	8	1.0	8	.6	7	1.4	8	.6	8	1.0	8	.9	8	1.7	8	.5
39. Confined Area Operations	8	.8	8	1.0	7	1.6	8	.9	7	1.2	8	.8	7	1.5	8	.9
40. Pinnacle/Ridgeline Operations	8	.8	8	1.6	7	2.3	8	1.3	7	1.1	8	1.0	8	1.7	8	.9
41. Ter. Flight Mission Planning	8	1.0	8	.7	8	1.8	8	.5	8	1.1	8	.5	8	1.0	8	.5
42. Ter. Flight Navigation	8	2.0	7	1.9	7	2.0	8	1.6	8	1.6	8	.5	8	2.1	8	.5
43. Low-Level Flight	8	.9	8	.9	8	1.3	8	.6	8	1.1	8	.7	8	.9	8	.9
44. NOE Flight	8	1.3	8	1.4	8	1.6	8	.6	8	1.4	8	.6	8	.8	8	.6
45. NOE Deceleration	7	1.2	8	.8	7	1.4	8	1.7	7	1.9	8	1.2	7	1.7	7	1.0
46. Ter. Flight Approach	8	1.2	8	1.4	8	1.3	8	.5	7	1.9	8	.6	8	.9	8	.5
47. OGE Check	7	1.7	8	1.3	7	1.7	8	1.4	7	2.1	8	1.0	7	2.3	8	1.9
48. Ter. Flight Takeoff	8	1.1	8	1.2	7	1.7	8	.9	8	1.2	8	.7	8	1.4	8	1.0

*Note. Task 35, Standard Autorotation with 180° Turn, was deleted from the task list.

TABLE 6

CORRELATIONS BETWEEN INITIAL CHECKRIDE NORMALIZED SCORES AND ROTARY WING FLIGHT HOURS

ATM TASK	TOTAL RW HOURS	RW HRS LAST 12 MOS.	RW HRS LAST 6 MOS.
1. Plan VFR Flight	-.08	.05	-.12
2. Weight and Balance Form	.00	.07	.02
3. Use Performance Charts	-.13	-.07	-.09
4. Prepare Performance Planning Cards (PPC)	-.10	-.06	-.13
5. Fuel Management	-.07	.01	.04
6. Preflight Inspection	.01	.09	.24*
7. Before Takeoff Checks	.03	.17	.29*
8. Communications Procedures	.12	.21	.34*
9. After Landing Tasks	.16	.14	.15
10. Takeoff to Hover	.05	.03	.21
11. Hover Check	.14	.07	.03
12. Hover Turn	.07	.10	.15
13. Hover Flight	.07	.17	.27*
14. Landing from Hover	.15	.09	.18
15. Manual Throttle Operation	.25*	.12	.17
16. Engine Failure at Hover	.37**	.00	.19
17. Hovering Autorotation	.25*	.07	.23*
18. Slope Operations	.24*	.12	.26*
19. Traffic Pattern	.34**	.16	.15
20. Climb/Descend	.24*	.24*	.22
21. Turns	.18	.12	.19
22. Straight-and-Level Flight	.10	.24*	.30**
23. Normal Takeoff	.06	.18	.25*
24. Maximum Performance Takeoff	.26*	.15	.32**
25. Before Landing Checks	.10	.14	.13
26. Normal Approach	.20	.27*	.35**
27. Steep Approach	.03	.15	.23*
28. Shallow Approach Running Landing	.07	.12	.24*
29. Hydraulic Failure	.13	.25*	.19
30. Antitorque Failure - Left	.04	.24*	.19
31. Antitorque Failure - Right	.16	.28*	.22*
32. Go-Around	.20	.07	.13
33. Standard Autorotation	.21	.11	.02
34. Low-Level Autorotation	.11	.28*	.21
36. Deceleration/Acceleration	-.02	.04	.17
37. Engine Failure at Altitude	.12	.04	.13
38. High Reconnaissance	.12	-.07	.03
39. Confined Area Operations	.11	-.15	.01
40. Pinnacle/Ridgeline Operations	.15	-.06	.06
41. Terrain Flight Mission Planning	-.15	.16	.32**
42. Terrain Flight Navigation	-.12	.21	.23*
43. Low-Level Flight	.03	.13	.28*
44. NOE Flight	-.06	.16	.16
45. NOE Deceleration	.25*	-.02	-.12
46. Terrain Flight Approach	.20	.04	.16
47. Out-of-Ground Effect Check	.02	.30**	.33**
48. Terrain Flight Takeoff	.20	.07	.05

Note. *p <.05 **p <.01, N = 78

TABLE 7

CORRELATIONS BETWEEN FINAL CHECKRIDE NORMALIZED SCORES AND ROTARY WING FLIGHT HOURS

	ATM TASK	TOTAL RW HOURS	RW HRS LAST 12 MOS.	RW HRS LAST 6 MOS.
1.	Plan VFR Flight	-.03	.17	.08
2.	Weight and Balance Form	-.02	.08	.14
3.	Use Performance Charts	-.07	.28*	.21
4.	Prepare Performance Planning Card (PPC)	-.02	.22*	.14
5.	Fuel anagement	-.02	.06	.03
6.	Preflight Inspection	.11	.23*	.25*
7.	Before Takeoff Checks	.17	.10	.08
8.	Communications Procedures	.12	.13	.20
9.	After Landing Tasks	.12	.35**	.24*
10.	Takeoff to Hover	.18	.03	.16
11.	Hover Check	.07	.08	.03
12.	Hover Turn	.30**	.01	-.00
13.	Hover Flight	.17	-.10	.04
14.	Landing from Hover	.33*	.11	.13
15.	Manual Throttle Operation	.15	.00	-.05
16.	Engine Failure at Hover	.29**	.04	.09
17.	Hovering Autorotation	.21	.04	.03
18.	Slope Operations	.16	.11	.14
19.	Traffic Pattern	.18	.08	.04
20.	Climb/Descend	.21	-.01	.05
21.	Turns	.25*	.25*	.17
22.	Straight-and-Level Flight	.32**	.25*	.19
23.	Normal Takeoff	.18	.22*	.34**
24.	Maximum Performance Takeoff	.10	.33**	.31**
25.	Before Landing Checks	.13	.17	.21
26.	Normal Approach	.15	.05	.19
27.	Steep Approach	.00	.18	.19
28.	Shallow Approach Running Landing	.11	.27*	.19
29.	Hydraulic Failure	.09	-.07	-.14
30.	Antitorque Failure - Left	.22	.30**	.30**
31.	Antitorque Failure - Right	.23*	.21	.29**
32.	Go-Around	.06	.01	.07
33.	Standard Autorotation	.11	.40**	.29**
34.	Low-Level Autorotation	.11	.24*	.32**
36.	Decel/Accel	-.10	-.07	-.06
37.	Engine Failure at Altitude	-.04	-.15	-.14
38.	High Reconnaissance	.08	.10	-.01
39.	Confined Area Operations	.14	.07	-.04
40.	Pinnacle/Ridgeline Operations	.18	.18	.14
41.	Terrain Flight Mission Planning	.04	.00	-.03
42.	Terrain Flight Navigation	.08	.16	.13
43.	Low-Level Flight	.13	.06	.05
44.	NOE Flight	.17	.15	.06
45.	NOE Deceleration	.03	-.09	-.19
46.	Terrain Flight Approach	.16	.20	.07
47.	Out-of-Ground Effect Check	.23*	-.19	-.11
48.	Terrain Flight Takeoff	.09	.07	-.03

Note. *p <.05 **p <.01, N = 78

TABLE 8

FACTOR LOADINGS, COMMUNALITIES, EIGENVALUES, AND PERCENTS OF VARIANCE FOR SIX FACTOR PRINCIPAL FACTORS EXTRACTION AND VARIMAX ROTATION OF ATM TASKS

ATM TASK	F_1	F_2	F_3	F_4	F_5	F_6	h^2
FACTOR 1							
Antitorque Failure-Left	.71	.13	.02	.10	.36	.17	.69
Standard Autorotation	.67	.12	.11	.28	.07	.10	.57
Antitorque Failure-Right	.66	.13	.08	.21	.27	.07	.58
Hydraulics Failure	.57	.31	.14	.08	.04	.14	.47
Low Level Autorotation	.56	.06	.20	.31	.16	.11	.50
Engine Failure at Hover	.55	.14	.40	.15	.09	.10	.53
Hovering Autorotation	.52	.19	.29	.20	.01	.14	.44
Manual Throttle	.46	.20	.15	.33	-.00	-.05	.39
Shallow Approach to Running Landing	.45	.05	-.05	.23	.18	.11	.31
FACTOR 2							
Low Level Flight	.06	.76	.02	.12	.35	.11	.73
Terrain Flight Mission Planning	.15	.75	.18	.07	.18	.09	.66
Terrain Flight Takeoff	.14	.72	.07	.20	.23	.15	.66
Out-of-Ground-Effect Check	-.08	.61	.24	.16	.09	.14	.50
NOE Flight	.31	.61	.05	.44	.08	.07	.67
Terrain Flight Navigation	.28	.57	.07	.12	-.03	.01	.28
Terrain Flight Approach	.10	.52	.16	.48	.07	.14	.56
FACTOR 3							
Landing From a Hover	.20	.05	.91	.06	.07	.11	.90
Hovering Turn	.12	.26	.83	.03	.06	.15	.79
Hovering Flight	.04	.28	.66	.12	.04	.15	.56
Takeoff to a Hover	.12	.07	.65	.07	.22	.10	.51
Normal Approach	.42	.06	.54	.41	.01	.10	.65
FACTOR 4							
High Reconnaissance	.12	.39	.07	.70	.04	.09	.68
Confined Area Operations	.16	.16	.08	.60	.18	.10	.46
Pinnacle/Ridgeline Operations	.39	.06	.05	.53	.13	.14	.48
Steep Approach	.29	-.02	.22	.52	.15	.16	.45
FACTOR 5							
Before Takeoff Checks	.01	.21	.02	-.05	.73	.05	.58
After Landing Tasks	.20	.09	.14	.24	.60	.04	.48
Hover Check	-.11	-.04	.16	.14	.57	-.04	.38
Preflight Inspection	.23	.46	.01	-.24	.58	.28	.73
Before Landing Checks	.17	.25	.08	.08	.50	.07	.36
FACTOR 6							
Climb/Descend	.22	.20	.28	.06	-.13	.77	.78
Turns	.31	.26	.24	.11	.16	.71	.77
Traffic Pattern	.11	.17	.21	.34	.03	.68	.66
Straight and Level Flight	.21	.18	.22	.27	.32	.67	.74
VARIABLES WITH FACTOR LOADINGS UNDER .45							
Plan VFR Flight	.33	.11	.23	-.15	-.21	.05	.25
Weight and Balance Form	.28	.06	.02	-.10	-.15	.09	.12
Performance Planning	.34	.08	.10	.36	-.20	-.26	.37
Fuel Management	.23	.07	.02	.12	-.13	-.13	.11
Radio Communication	.21	.31	.07	.07	.37	.05	.29
Slope Operations	.44	.16	.24	.02	.04	.26	.34
Normal Takeoff	.29	.29	.38	.22	.14	.18	.42
Maximum Performance Takeoff	.41	.21	.26	.30	.18	.15	.43
Go-Around	.15	.41	.26	.06	.09	.09	.28
Deceleration/Acceleration	.10	.31	.05	.41	-.00	.20	.32
Engine Failure at Altitude	.21	.43	.16	.00	-.04	.04	.26
NOE Deceleration	.21	.31	.38	.13	.07	.18	.34
Eigenvalue	13.00	2.79	2.41	1.93	1.51	1.49	
Percent of Variance	56.30	12.10	10.40	8.30	6.50	6.40	
Cumulative Percent of Variance	56.30	68.40	78.70	87.10	93.60	100.00	

Note. N = 78

To check for the possibility of correlations among the factors, an oblique rotation was also performed. The oblique rotation yielded almost the identical six factors, with no two factors correlating greater than .36. Therefore, orthogonal rotation was retained because of its conceptual simplicity and its ease of interpretation.

Examination of the tasks with significant loadings on each factor suggests the following descriptive labels: Factor 1 (56.3% of common variance) - Emergency Tasks; Factor 2 (12.1%) - Terrain Flight Tasks; Factor 3 (10.4%) - Hovering Tasks; Factor 4 (8.3%) - High-Angle Approaches; Factor 5 (6.5%) - Procedural Tasks; Factor 6 (6.4%) - Basic Flight Tasks.

Examination of the correlations between final checkride normalized scores and final checkride composite scores (Appendix H) suggested that overall checkride performance (as estimated by the composite score) could be reliably predicted by using a small set of predictor tasks that have high predictor-criterion correlations and low predictor intercorrelations (Landy & Trumbo, 1980). Two unique sets of ten tasks were formed by sampling tasks from the six factors approximately in proportion to the number of tasks which had loadings greater than .45 on each factor. The sets are presented in Table 9. When tasks from the two sets are used as independent variables in separate multiple regression analyses to predict final checkride composite scores, a coefficient of multiple determination (R^2) of .87 (corrected for shrinkage) is obtained (Stein, 1960).

CONFIDENCE RATINGS

Means, standard deviations, and intercorrelations among the ratings on the 100-point confidence scale and the final checkride normalized scores for each of the 47 tasks are given in Appendix I. There are small or nonsignificant correlations between confidence ratings and checkride scores. In contrast, the confidence ratings obtained prior to a checkride are highly correlated with ratings obtained after the checkride.

TABLE 9

SETS OF ATM TASKS USED TO PREDICT
FINAL CHECKRIDE COMPOSITE SCORE

TASK SET A

ANTITORQUE FAILURE - RIGHT
STANDARD AUTOROTATION
ENGINE FAILURE AT A HOVER
TERRAIN FLIGHT MISSION PLANNING
NOE FLIGHT
LANDING FROM A HOVER
CONFINED AREA OPERATIONS
STEEP APPROACH
AFTER LANDING CHECKS
STRAIGHT AND LEVEL FLIGHT

TASK SET B

ANTITORQUE FAILURE - LEFT
LOW LEVEL AUTOROTATION
HOVERING AUTOROTATION
TERRAIN FLIGHT NAVIGATION
TERRAIN FLIGHT TAKEOFF
HOVERING TURN
NORMAL APPROACH
HIGH RECONNAISSANCE
PREFLIGHT INSPECTION
TRAFFIC PATTERN

DISCUSSION

The results indicate that the average level of flight performance in helicopter contact and terrain flight tasks is maintained after a six-month period of no practice. Furthermore, the average level of performance does not significantly increase with as many as six practice iterations. These finding applies to (a) both high flight time aviators (those with more than 900 rotary wing hours) and low flight time aviators (those with less than 900 hours) and (b) both psychomotor tasks and procedural tasks. Overall final checkride performance can be predicted reliably using scores on a small number of tasks sampled from independent task dimensions. Self-rated confidence to perform final checkride tasks is not a reliable predictor of either initial or final checkride performance.

CHECKRIDE SCORES

Analysis of Variance

The data from the analyses of the psychomotor tasks are consistent with past research on the retention of flight skills (e.g., Mengelkoch et al., 1960; Wright, 1973; Sitterley & Berge, 1972; Smith & Matheny, 1976) and the general literature on retention of psychomotor skills (e.g., Ammons et al., 1958; Parker & Fleishman, 1960). These studies indicate that skill levels for psychomotor tasks will be maintained at satisfactory levels for periods exceeding the six-month period used in the present study.

The lack of change in average proficiency level for the procedural tasks evaluated in this research (with the exception of an increase in average proficiency on the task Prepare Weight and Balance Form) was surprising. Based on past research, one would have expected some loss of proficiency on the procedural tasks after six months of no practice, even if no loss was observed on the psychomotor tasks. The results suggest that proficiency loss may be less severe for some types of procedural tasks than for others. This finding needs to be supported by additional research.

Most of the contact and terrain flight tasks examined in the present research have large psychomotor components. Many tasks that have large procedural components, such as the ATM FAC 2 instrument tasks and the ATM task Describe or Perform Emergency Procedures, were not evaluated in the present research because they are trained and evaluated in the UH-1 flight simulator. Past research indicates that losses in proficiency and improvements with practice may be found in procedural tasks such as these after a no-practice period of six months (Mengelkoch, et al., 1960). This warrants further examination.

Overall initial checkride performance was correlated ($\underline{r}$ = .42) with overall final checkride performance for the subjects that did not fly for six months. Although the correlation did not reach statistical significance--possibly due to the small sample size of the 0 iteration group ($\underline{n}$ = 11)--it is in the expected direction and is consistent with past research.

Performance did not improve on tasks for which the average performance was below ATM proficiency levels on the initial checkride. This finding was unexpected. Initial checkride performance that was below proficiency was primarily on emergency tasks (e.g., Antitorque Failures, Hydraulic Failure, Standard Autorotation, Low Level Autorotation).

Two factors may have contributed to the failure to demonstrate a significant improvement in the performance of these tasks. First, in order to control the number of times each task was practiced, flights were structured so that each task was practiced once without previous instruction or demonstration, with the exception of the two Antitorque Failure tasks that were demonstrated once by the IP before they were attempted by the subject. Tasks that are inherently difficult and for which initial skill is deficient or marginal may require extensive instruction, demonstration, and massed practice trials for significant performance improvement to occur in a six-month period. Second, more than six iterations of distributed practice may be required to either regain or retain proficiency in these tasks.

Factor Analysis

The results of the factor analysis of final checkride normalized scores suggest the presence of independent dimensions underlying rotary wing contact and terrain flight skills. Although the sample size employed in the research (N = 78) is relatively small by standards adopted for factor analysis (Comrey, 1973), the six factors that emerged from the principal factors extraction and the varimax rotation appear to be reliable based on the size and pattern of factor loadings, eigenvalues, common variance accounted for, and communalities. The reliability of the factors should be investigated in additional research.

Examination of the tasks that loaded on each of the six factors suggests the descriptive categories of Emergency Tasks, Terrain Flight Tasks, Hovering Tasks, High-Angle Approaches, Procedural Tasks, and Basic Flight Tasks. The factors emerged on the basis of mathematical relationships among the variables; yet, with the exception of Factor 5, the groups are consistent with preexisting categories found in Army training literature defined on the basis of intuitive similarities of the tasks (e.g., Hovering, Terrain Flight).

It is noteworthy, in view of previous research in the area of flight skill retention, that a factor composed of procedural tasks was extracted independently from factors with tasks having large psychomotor components. Previous research indicates that psychomotor and procedural skills may have different proficiency maintenance requirements as well as different training requirements (Prophet, 1976).

The finding that overall checkride performance can be accurately predicted with a small subset of tasks has several implications for performance evaluation. These results suggest that it is possible to evaluate checkride performance with relatively few tasks, if the individual tasks are highly correlated with overall checkride performance and are selected to sample relatively independent aspects of overall flight skill. The use of fewer tasks would reduce the time required for evaluation checkrides and save fuel and IP time, both being increasingly scarce resources in Army aviation.

CONFIDENCE RATINGS

As measured in the present study, self-rated confidence is not a reliable predictor of checkride performance. Similar data from the area of judgment and decision making (Lichtenstein & Fishhoff, 1977) indicate that subjects' predictions of task performance are subject to systematic biases, particularly overconfidence, and are generally not reliable predictors of actual performance. As stated previously, confidence ratings were obtained to provide data for exploratory analyses. The data, in conjunction with previous research, raise several questions about the viability of the construct of confidence.

GENERALIZABILITY OF RESULTS

The purpose of the present research is to validate, or determine the appropriateness of, the number of iterations required for Army aviators to maintain flight proficiency over a six-month training period. It is not possible to estimate from these data what flight proficiency loss might be expected for retention intervals longer than six months. The literature on the retention of flight skills suggests that significant decrements in flying proficiency might occur within a period of one to two years, particularly on flight tasks with large procedural components. Likewise, it is not possible to generalize directly from the data to emergency, instrument, night, or mission-specific tasks.

ARI is currently conducting research to evaluate the skill retention of Individual Ready Reserve aviators who have been trained to flight proficiency level and who have not flown for one year (Wick, 1983). Data from this research will provide an opportunity to examine the amount of proficiency loss among rotary wing aviators that occurs after a one-year retention interval. Additional research is needed to empirically investigate skill retention of rotary wing flight skills for periods longer than one year, using a representative sample that is large enough to allow examination of such variables as types of experience and types of flight tasks.

IMPLICATIONS FOR ATM PROGRAM

The results of the research have two major implications for the current ATM program. First, initial levels of aviator flight proficiency will be maintained in a large number of ATM FAC 2 contact and terrain flight tasks over a six-month period with little or no practice. No conclusion can be drawn about maintaining ATM standards in emergency tasks over six months. The data indicate that as many as six iterations of distributed practice without extensive instruction and demonstration may not improve performance in emergency tasks from an initial level of proficiency that is below ATM standards.

Second, the requirement for all aviators to fly current minimum semiannual FAC 2 iterations and for aviation field unit personnel to maintain records on performance of iterations for the majority of contact and terrain flight tasks may not be justified.

CONCLUSIONS

The following conclusions are drawn from this research.

1. The average level of flight performance in helicopter FAC 2 contact and terrain flight tasks is maintained after a six-month period of no practice. Furthermore, the average level of performance does not significantly increase with as many as six practice iterations. Sufficient data are not available to generalize the findings to periods beyond six months or to instrument, emergency, night, or mission-specific tasks.

2. The results do not support the requirement for aviators to perform the current minimum number of ATM FAC 2 contact and terrain flight task iterations over a six-month training period.

3. The total number of rotary wing flight hours is not a reliable predictor of an aviator's proficiency level at the end of a six-month period.

4. Overall final checkride performance can be reliably estimated using scores on a small number of final checkride tasks that are highly correlated with overall checkride performance and sampled from independent dimensions of flight skills.

5. Aviators' confidence ratings are not a reliable predictor of actual checkride performance.

REFERENCES

Allnutt, M. F., & Everhart, C. D. Retraining Army aviators following a protracted absence from flying (Field Unit Research Report 1296). Fort Rucker, AL: U.S. Army Research Institute for the Behavioral and Social Sciences, October 1980. ADA109286

Ammons, R. B., Farr, R. P., Bloch, E., Neuman, E., Day, M., Marion, R., & Ammons, C. H. Long-term retention of perceptual-motor skills. Journal of Experimental Psychology, 1958, 55, 318-328.

Bickley, W. R. Optimizing simulator aircraft mixes. Proceedings of the Interservice/ITEC Conference, Salt Lake City, UT, 1980.

Comrey, A. L. A first course in factor analysis. New York: Academic Press, 1973.

Department of the Army. Utility helicopter aircrew training manual (TC 1-135). Washington, DC: Department of the Army, 1981.

Dwyer, J. H. Analysis of variance and the magnitude of effects: A general approach. Psychological Bulletin, 1974, 81, 731-737.

Engelman, L., Frane, J. W., & Jennrich, R. I. BMDP-77: Biomedical computer programs - P series. Berkeley, CA: University of California Press, 1977.

Gardlin, G. R., & Sitterley, T. E. Degradation of learned skills--a review and annotated bibliography. Seattle, WA: Boeing Company, D180-15080-1, June 1972.

Hays, W. L. Quantification in psychology. Belmont, CA: Brooks/ Cole, 1967.

Holman, G. L. Training effectiveness of the CH-47 flight simulator (Research Report 1209). Fort Rucker, AL: U.S. Army Research Institute Field Unit, May 1979. ADA072317

HumRRO Division No. 6 (Aviation). A test of synthetic training in combat readiness proficiency training (unpublished internal research report). Fort Rucker, AL: Human Resources Research Organization, June 1974.

Landy, F. J., & Trumbo, D. A. Psychology of work behavior. Homewood, IL: The Dorsey Press, 1980.

Lichtenstein, S., & Fischhoff, B. Do those who know more also know more about how much they know? Organizational Behavior and Human Performance, 1977, 20, 159-183.

Lovejoy, R. K., & Presley, W. N. Aircrew training manuals. Aviation Digest, September 1980.

Mengelkoch, R. F., Adams, J. A., & Gainer, C. A. The forgetting of instrument flying skills as a function of the level of initial proficiency (NAVTRADEVCEN TR 71-16-18). Port Washington, NY: U.S. Naval Training Device Center, 1960.

Naylor, J. C., & Briggs, G. E. Long term retention of learned skills: a review of the literature (ASD Tech. Rep. 61-390). Canton, OH: Wright-Patterson Air Force Base, Aerospace Medical Laboratory, August 1961.

Parker, J. F., & Fleishman, E. A. The retention of a continuous control perceptual-motor skill (Technical Report DRA 60-37). Washington, DC: Office of Naval Research, July 1960.

Prophet, W. W. Long-term retention of flying skills: a review of the literature (HumRRO Tech. Rep. 76-35). Alexandria, VA: Human Resources Research Organization, October 1976.

Ruffner, J. W., Ciley, D. C., & Wick, D. W. Application of pilots' night training device to daytime training in night terrain flight emergency maneuvers (Field Unit Work Paper FR/FU 80-8). Fort Rucker, AL: U.S. Army Research Institute for the Behavioral and Social Sciences, January 1981.

Schendel, J. D., Shields, J. L., & Katz, M. S. Retention of motor skills: review (Technical Paper 313). Washington, DC: U.S. Army Research Institute for the Behavioral and Social Sciences, September 1978. ADA061338

Sitterley, T. E., & Berge, W. A. Degradation of learned skills--effectiveness of practice methods on simulated space flight skill retention (Document D180-15081-1). The Boeing Company, July 1972.

Smith, J. F., & Matheny, W. G. Continuation versus recurrent pilot training (AFHRL-TR-76-4). Brooks AFB, TX: Air Force Human Resources Laboratory, May 1976.

Stein, C. Multiple regression. In I. Olkin et al. (Eds.), Contributions to probability and statistics. Stanford: Stanfrod University Press, 1960.

Welford, A. T. On the nature of skill. In D. Legge (Ed.) Skills (pp. 21-32). Harmondsworth, UK: Penguin Books Ltd., 1970.

Wick, D. T. Revision/validation of the individual ready reserve (IRR) aviator program (Working Paper). Fort Rucker, AL: U.S. Army Research Institute Field Unit, 1983.

Wright, R. H. Review of behavioral science research data relevant to Army proficiency flying programs (HumRRO Division No. 6 (Aviation) Consulting Report). Fort Rucker, AL: Human Resources Research Organization, April 1969.

Wright, R. H. Retention of flying skills and refresher training requirements: effects of non-flying and proficiency flying (HumRRO Technical Report 73-32). Alexandria, VA: Human Resources Research Organization, December 1973.

APPENDIX A

DEMOGRAPHIC QUESTIONNAIRE

ATM QUESTIONNAIRE

1. NAME: ____________ (Last) ____________ (First) ____________ (M.I.)   2. DATE: ____________ (Day/Month/Year)

3. RANK: ____________   4. SSN: ____________

5. AGE: ____________ Years   6. SSI: ____________

7. DATE GRADUATED FROM FLIGHT SCHOOL: ____________ Month/Year

FOR ITEMS 8 - 15, PLEASE CHECK [ ] APPROPRIATE SPACES AND FILL IN THE BLANKS TO INDICATE YOUR TOTAL AVIATION BACKGROUND AND EXPERIENCE. MAKE YOUR BEST ESTIMATE OF HOURS ±50.

8. PLEASE INDICATE YOUR ROTARY WING QUALIFICATIONS AND HOURS LOGGED BY AIRCRAFT TYPE.

UH-1:	[ ] Pilot	[ ] UT	[ ] IP	[ ] SIP	Total Hours ______
AH-1:	[ ] Pilot	[ ] UT	[ ] IP	[ ] SIP	Total Hours ______
OH-58:	[ ] Pilot	[ ] UT	[ ] IP	[ ] SIP	Total Hours ______
CH-47:	[ ] Pilot	[ ] UT	[ ] IP	[ ] SIP	Total Hours ______
UH-60:	[ ] Pilot	[ ] UT	[ ] IP	[ ] SIP	Total Hours ______

ROTARY WING IFE [ ]

9. PLEASE LIST OTHER ROTARY WING QUALIFICATIONS, IF APPROPRIATE:

Aircraft ____________   Total Hours ______

Aircraft ____________   Total Hours ______

Aircraft ____________   Total Hours ______

Total Rotary Wing Hours ______

10. IF YOU HAVE SERVED A TOUR AS A ROTARY WING IP AT FORT RUCKER, INDICATE IN WHAT CAPACITY AND THE NUMBER OF HOURS YOU LOGGED:

[ ] Contact . . . . ______ Hours   [ ] Tactics . . . . . ______ Hours

[ ] Instruments . . . . . ______ Hours   [ ] IP MOI. . . . . . ______ Hours

[ ] NH/NVG. . . . . ______ Hours

11. TOTAL ROTARY WING IP HOURS: ______

12. PLEASE INDICATE YOUR ROTARY WING HOURS DURING THE:

Previous 12 Months ______   Previous 6 Months ______   Previous 1 Month ______

13. PLEASE INDICATE YOUR SIMULATOR HOURS: Total Hours ______ Hours During Previous 12 Months ______

14. PLEASE INDICATE YOUR FIXED WING QUALIFICATIONS AND HOURS LOGGED:

[ ] Fixed Wing Military   [ ] Fixed Wing Instructor
[ ] Fixed Wing Civilian   [ ] Fixed Wing IFE

Total Fixed Wing Hours ______   Hours During Previous 12 Months ______

15. DESCRIBE BELOW THE DUTY ASSIGNMENT/POSITION YOU HELD PRIOR TO BEING ASSIGNED TO USAAVNC.

____

16. WAS PREVIOUS ASSIGNMENT IN AVIATION?   [ ] YES   [ ] NO

17. WHAT FAC WAS YOUR PREVIOUS ASSIGNMENT?   [ ] FAC 1   [ ] FAC 2

18. DESCRIBE BELOW EACH DUTY ASSIGNMENT/POSITION YOU HAVE HELD AT FORT RUCKER DURING YOUR PRESENT TOUR.

1. ____

2. ____

3. ____

19. WHAT IS THE JOB TITLE OF YOUR PRESENT DUTY ASSIGNMENT? ____________

20. WHAT WAS THE DATE OF YOUR PRESENT ASSIGNMENT TO FORT RUCKER? ____________ Month/Year

APPENDIX B

ACADEMIC TEST MATERIALS

INSTRUCTIONS

1. This booklet contains reference material and data necessary to perform the following ATM tasks:

- Plan VFR Flight
- Prepare DD Form 365F (Weight and Balance)
- Use Performance Charts
- Prepare Planning Card (PPC)
- Perform Fuel Management Procedures

2. This booklet will be used by a number of aviators during this phase of the ATM Validation Project. Please do not make any marks in the booklet or remove any pages from the booklet.

3. Answer sheets (DD Form 175, DD Form 365F, DA Form 4887-R) as well as a blank sheet for calculations will be provided.

MILITARY FLIGHT PLAN

AIRCRAFT UNIT OF ASSIGNMENT/HOME STATION | AIRCRAFT SERIAL NO.

TYPE OF FLIGHT PLAN | RADIO CALL | AIRCRAFT DESIGNATION/TO CODE | ESTIMATED TIME ENROUTE | DEPARTURE TIME (Z): PROPOSED, ACTUAL

POINT OF DEPARTURE | STANDARD INSTRUMENT DEPARTURE: NAME AND NUMBER, TO

		ROUTE OF FLIGHT	TO	ETE

PSGR/CARGO CODE

HOURS FUEL ON BOARD | DIST TO DESTN | ALTERNATE AIR FIELD | ETE TO ALTN | NOTAMS | DD FORM 365F (WT. BAL.) | WEATHER | REQUEST CLEARANCE AFTER

SIGNATURE OF PILOT IN COMMAND | SIGNATURE OF APPROVING AUTHORITY | DATE

CREW/PASSENGER LIST

DUTY	NAME AND INITIALS	GRADE	SSAN	ORGANIZATION AND LOCATION
PILOT IN COMMAND				

WEIGHT AND BALANCE CLEARANCE FORM F

TRANSPORT

DD FORM 365F

RW PERFORMANCE PLANNING CARD (PPC)

(DEPARTURE)				
PA	FAT			
T/O GWT	LOAD			
CAL FACTOR	FUEL			
	DUAL ENG	SINGLE ENG CA*	IND	
* MAX (TQ/%) AVAIL				
(TQ/% AVAIL (CONT)				
* GO-NO-GO (TQ/%)				
* PREDICT HOVER (TQ/%)				
HOVER OGE (TQ, %)				
* MAX ALLOWABLE GWT				
MAX R/C - ENDURANCE IAS				
MAX RANGE IAS				
VALIDATION FACTOR ____				
* SAFE PEDAL MARGIN	YES ____	NO ____		

Based on aircraft performance for existing atmospheric conditions

(ARRIVAL)			
PA	FAT		
LANDING GWT	MAX ALLOWABLE GWT		
	DUAL ENG IND	SINGLE ENG CAL	IND
MAX (TQ/%) AVAIL			
* (TQ/%) REQ TO HOVER IGE			
* (TQ/%) REQ TO HOVER OGE			
* SAFE PEDAL MARGIN	YES ____	NO ____	

DA Form 5577-R (1 Jul 88)

Arrival data is computed when significantly different from T/O conditions

Based on aircraft performance for existing conditions

*Mandatory for all flights

FIGURE 6-1

FUEL CHECK:	FUEL/TIME	CONSUMPTION RATE ____	LBS/HR
START: ____		BURN OUT ____	Z
STOP: ____		RESERVE ____	Z
LCT RET	KIAS/FROB		KIAS
OPTIONAL DATA			
WT COMPUTATION			
BASIC WT (OIL INCL)			
CREW & FLT EQUIP			
EMER OR OTHER EQUIP			
OPERATING WT			
FUEL WT			
PAX-BAGGAGE-CARGO			
TAKEOFF WT	(MINUS R/W FUEL)		
CRUISE DATA			
PA	FAT	VNE	KIAS
	SINGLE ENG	DUAL ENG	
CRUISE SPEED	____ KIAS ____ KIAS	____ KIAS ____ KIAS	
CRUISE (TQ/%)			
CRUISE FUEL FLOW			
REMARKS:			

*Mandatory for all flights

FIGURE 6-1 (Cont)

FUEL CHECK DATA

	FUEL	TIME
START:	1180	1400
STOP:	1000	1423

FUEL CONSUMPTION RATE CHECK IS COMPLETED AT 1425 HOURS WITH 980 LBS. OF FUEL REMAINING.

WEIGHT & BALANCE DATA

	WEIGHT	MOMENT/100
BASIC AIRCRAFT	5600	7700
OIL	27	47
CREW OF (2)	200 EA	93 EA
TAKEOFF FUEL	1359	2078
PASSENGERS (2)	200 EA @ F.S.	117.0

LESS FUEL - (BASED ON LANDING WITH THE MOST CRITICAL FORWARD CG OF 73.2)

REMARKS:

1. FUEL USED IS JP-4
2. CRASHWORTHY FUEL SYSTEM

VFR FLIGHT PLAN DATA

UNIT - USAAVNC

AIRCRAFT NUMBER - 68-16354

TRANSPONDER WITH MODE "C"

DEPARTURE TIME (Z) - 1400

DEPARTURE POINT - LOWE AHP

ROUTE OF FLIGHT - AO VANGARD

FUEL ON BOARD - 2 + 15

WEIGHT & BALANCE - 1 Jun 82

CREW MEMBERS - ASSIGNED TO DES/FTR

PILOT - C. D. JONES, DAC, 215 631554

COPILOT - M. B. BROWN, CW3, 154 605405

DEPARTURE DATA

PRESSURE ALTITUDE = 4000

CALIBRATION FACTOR = 58.0

FAT = +20

T/O GWT = 7500

FLIGHT CONDITION = VFR

WITH THE ABOVE INFORMATION, COMPLETE ALL ASTERISKED ITEMS LISTED ON THE RW PERFORMANCE PLANNING CARD (PPC). ARRIVAL DATA ARE NOT SIGNIFICANTLY DIFFERENT FROM T/O CONDITIONS.

LOWE			
TOWER	141.30	237.30	32.00
GND CON		265.60	
ATIS		364.90	
RUNKLE			
NORTH CON		365.20	
SOUTH CON		233.10	
FCC			
PIRATE CON		394.00	
SAVAGE CON		280.0	
ASR			
(ANGEL) FEEDER CON		373.50	
FINAL CON		339.90	
SHELL			
TOWER		240.80	46.90
REFUELING		249.00	
COMMON FREQ			50.65
NDB's			
LOWE	308		
BOLLWEEVIL	269		
RUNKLE	251		

VFR FLIGHT PLAN DATA

UNIT - USAAVNC

AIRCRAFT NUMBER - 68-16354

TRANSPONDER WITH MODE "C"

DEPARTURE TIME (Z) - 1400

DEPARTURE POINT - LOWE AHP

ROUTE OF FLIGHT - AO VANGARD

FUEL ON BOARD - 2 + 15

WEIGHT & BALANCE - 1 Jun 82

CREW MEMBERS - ASSIGNED TO DES/FTR

PILOT - C. D. JONES, DAC, 215 631554

COPILOT - M. B. BROWN, CW3, 154 605405

		LOWE	
TOWER	141.30	237.30	32.00
GND CON		265.60	
ATIS		364.90	
		RUNKLE	
NORTH CON		365.20	
SOUTH CON		233.10	
		FCC	
PIRATE CON		394.00	
SAVAGE CON		280.0	
		ASR	
(ANGEL) FEEDER CON		373.50	
FINAL CON		339.90	
		SHELL	
TOWER		240.80	46.90
REFUELING		249.00	
COMMON FREQ			50.65
		NDB's	
LOWE	308		
BOLLWEEVIL	269		
RUNKLE	251		

FUEL LOADING
CRASHWORTHY SYSTEM TANKS

EXAMPLE

WANTED

WEIGHT AND MOMENT FOR KNOWN FUEL TYPE AND QUANTITY

KNOWN

QUANTITY — 209 GALLONS (1421 POUNDS ON JP-5 SCALE)

METHOD

MOVE RIGHT FROM 1421 ON JP-5 SCALE TO DIAGONAL LINE. PROJECT DOWN FROM THIS POINT TO READ 2170 ON MOMENT/100 SCALE

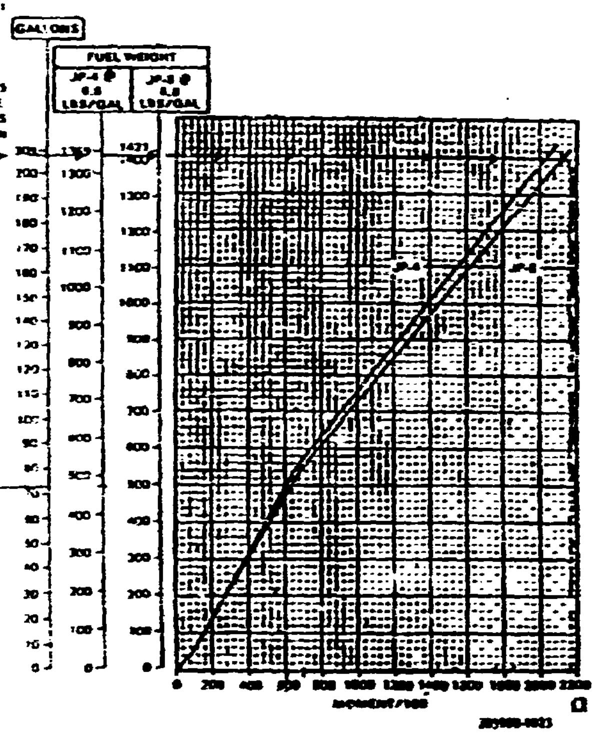


Figure 6-14. Fuel data (Sheet 1 of 4)

PERSONNEL LOADING CHART
MOMENT FOR PERSONNEL

EXAMPLE

WANTED

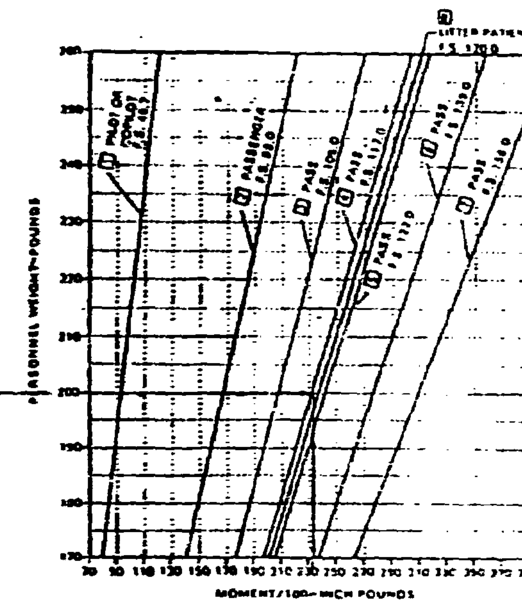
PERSONNEL MOMENT FOR A GIVEN WEIGHT AND LOCATION

KNOWN

PERSONNEL WEIGHT OF 200 POUNDS AT F.S. 117.0

METHOD

MOVE RIGHT FROM 200 POUNDS TO THE PASSENGER LINE F.S. 117.0, PROJECT DOWN TO READ 234 ON THE MOMENT/100 SCALE



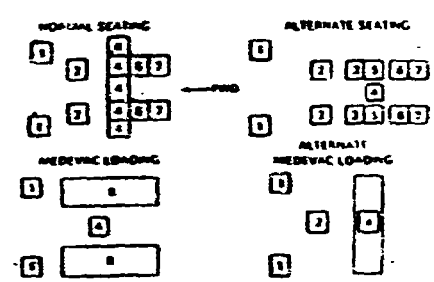


Figure 6-5. Personnel moment

CENTER OF GRAVITY LIMITS

C.G. LIMITS

EXAMPLE

WANTED

DETERMINE CENTER OF GRAVITY FOR KNOWN WEIGHT AND MOMENT

KNOWN

GROSS WEIGHT EQUAL 7689 POUNDS MOMENT/100 EQUAL 10050 INCH POUNDS

METHOD

MOVE RIGHT FROM 7689 POUNDS TO A POINT APPROXIMATELY 1/2 OF THE DISTANCE BETWEEN 10000 AND 10100 INCH POUNDS DIAGONAL LINES. FROM THIS POINT PROJECT DOWN TO READ 141.5 ON THE CENTER OF GRAVITY SCALE FUSELAGE STATION IN INCHES

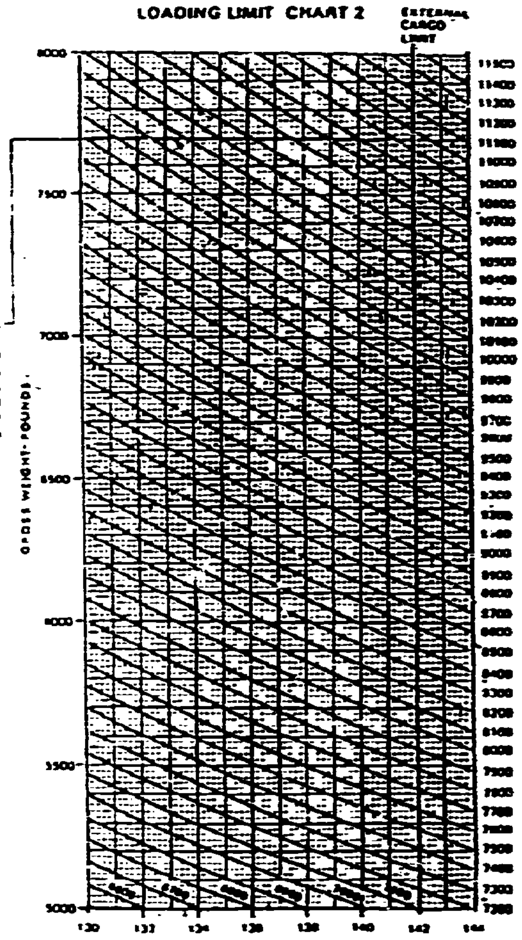


Figure 6-16. Center of gravity limits (Sheet 2 of 2)

205900-1029-2

OIL DATA					
TYPE	TANK CAPACITY (GAL)	WEIGHT PER GALLON	TOTAL WEIGHT (LBS)	ARM F.S.	MOMENT IN-LB/100
MIL-L-7808 *	3.25	7.5	24.4	172.8	42
MIL-L-7808	3.0	7.5	22.5	172.8	38.9
MIL-L-23699 *	3.25	8.4	27.3	172.8	47
MIL-L-23699	3.0	8.4	25.2	172.8	43.6

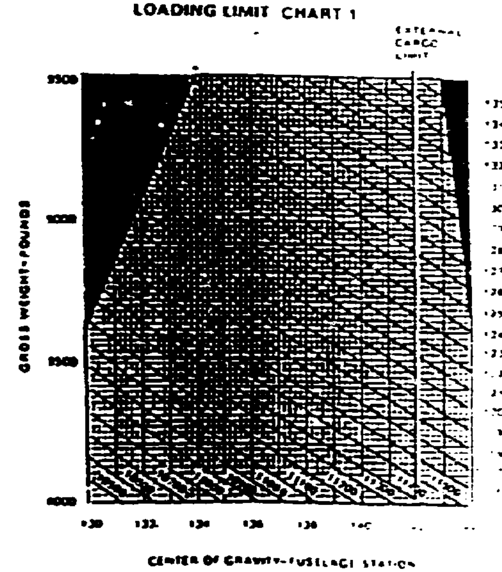
* Ferry Flight

205900-1027

Figure 6-15. Engine oil data

CENTER OF GRAVITY LIMITS

C.G. LIMITS



205900-1029-1

Figure 6-16. Center of gravity limits (Sheet 1 of 2)

MAXIMUM TORQUE AVAILABLE (30 MINUTE OPERATION)

ANTI-ICE OFF BLEED AIR HEATER OFF
324 ROTOR/6600 ENGINE RPM JP-4 FUEL

MAXIMUM TORQUE UH-1H EH-1H T53-L-13

EXAMPLE

WANTED

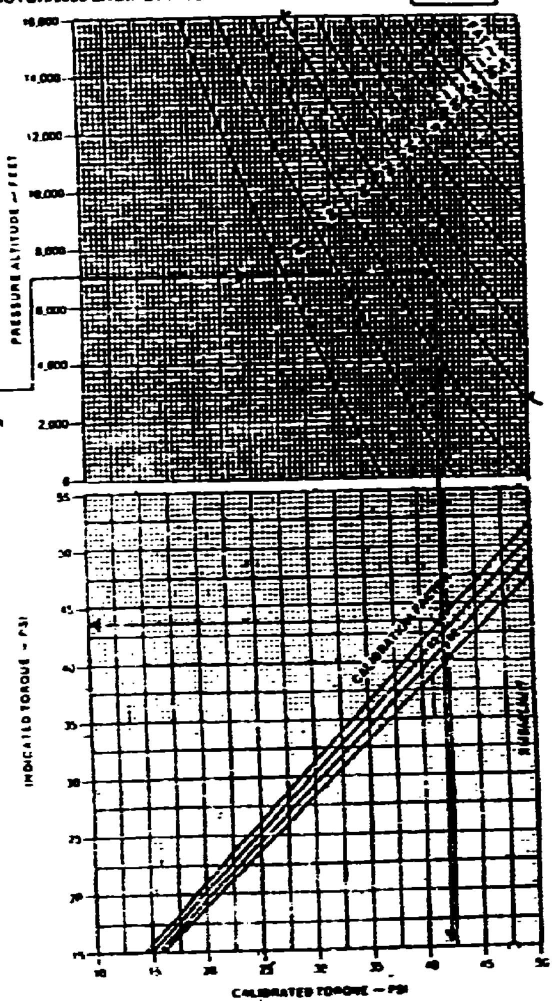
CALIBRATED AND INDICATED TORQUE

KNOWN

PRESSURE ALTITUDE = 7000 FEET
CALIBRATION FACTOR = 84
FAT = + 20°C

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO FAT
MOVE DOWN TO CALIBRATION FACTOR
MOVE LEFT READ INDICATED
TORQUE = 43.5 PSI
FOR CALIBRATED TORQUE
CONTINUE FROM FAT DOWN
THROUGH THE CALIBRATION
FACTOR READ CALIBRATED
TORQUE = 41.7 PSI



DATA BASIS: FROM SPEC 104.33 6 MAY 1964 CORRECTED FOR INSTALLATION; FLIGHT TEST ASTA TDR 66-04 NOVEMBER 1970

EH Figure 7-3. Maximum torque available (30 minute operation) chart

HOVER

324 ROTOR/6600 ENGINE RPM CALM WIND LEVEL SURFACE

HOVER UH-1H EH-1H

WANTED

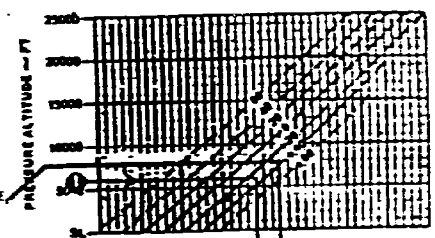
TORQUE REQUIRED TO HOVER

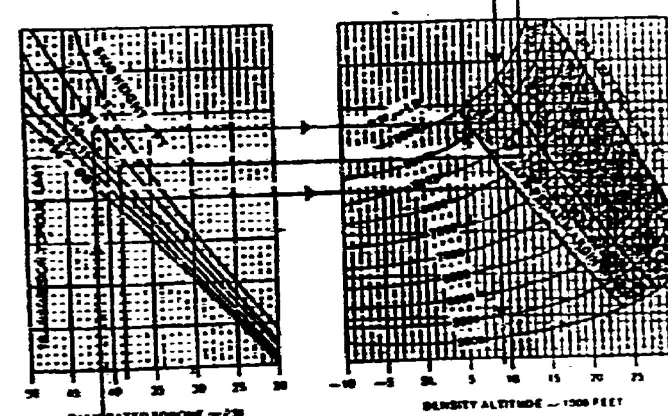
KNOWN

PRESSURE ALTITUDE = 8500 FT
OAT = 25°C
GROSS WEIGHT = 8400 LB
DESIRED SKID HEIGHT = 5 FT

METHOD

ENTER PRESSURE ALTITUDE HERE
MOVE RIGHT TO OAT
MOVE DOWN TO GROSS WEIGHT
MOVE LEFT TO SKID HEIGHT
MOVE DOWN, READ TORQUE
REQUIRED TO HOVER = 30.5 PSIG





DATA BASIS: DERIVED FROM UH-1H FLIGHT TEST, ASTA-TDR 66-04, NOVEMBER 1970

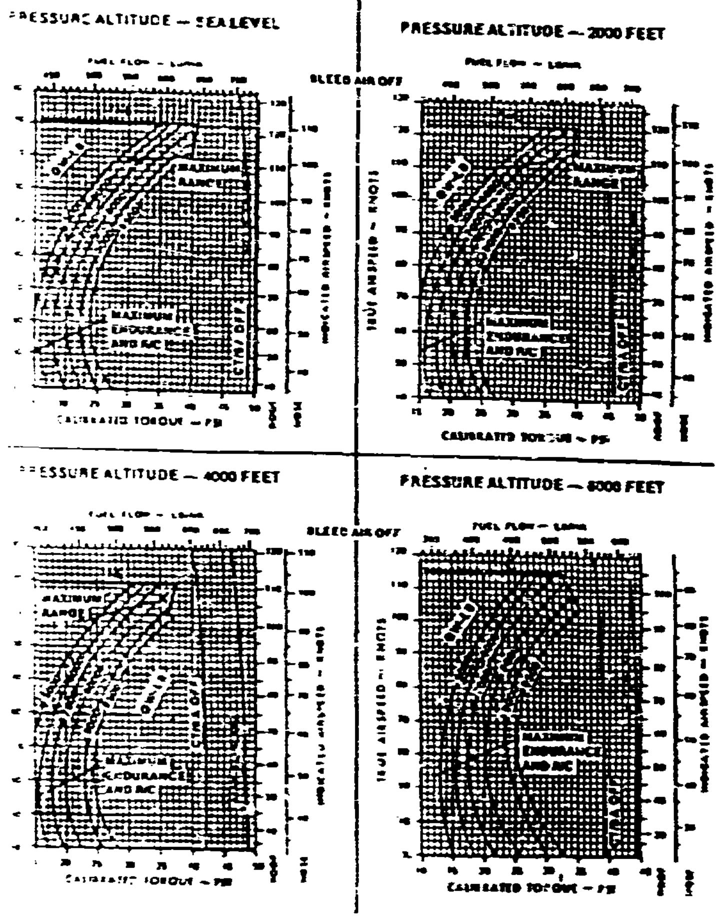
EH Figure 7-5. Hover Chart

CRUISE

PRESSURE ALTITUDE — SEA LEVEL TO 8000 FEET
CLEAN CONFIGURATION 324 ROTOR/6600 ENGINE RPM

CRUISE
T53-L-13

FAT = 20°C



H Figure 7-7. Cruise chart, clean configuration, 20°C, sea level to 8000 feet (Sheet 14 of 18)

DIRECTIONAL CONTROL MARGIN (IGE TRANSLATIONAL FLIGHT)

CONTROL MARGIN UH-1D/H & EH-1H

EXAMPLE

WANTED

CONDITIONS (AIRSPEED — AZIMUTH) WHERE DIRECTIONAL CONTROL MARGIN MAY BE LESS THAN 10%

KNOWN

PRESSURE ALTITUDE = 5000 FEET
FAT = 0°C
GROSS WEIGHT = 8500 POUNDS

METHOD

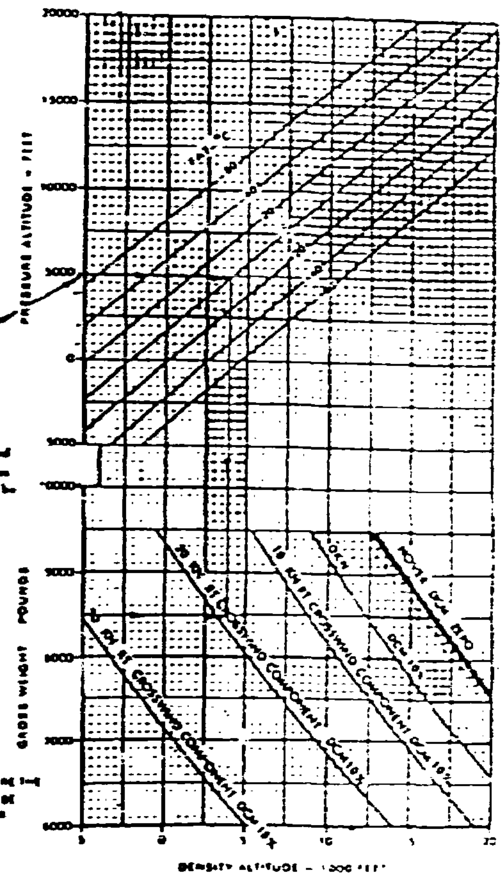
ENTER PRESSURE ALTITUDE HERE

MOVE RIGHT TO FAT

MOVE DOWN TO KNOWN GROSS WEIGHT

Determine the intersection of gross weight and density altitude lines in 19 knots. This indicates the maximum crosswind component that can be encountered and still be at 10% directional control margin.

Refer to sheet 2. Directional control margin may be less than 10% for crosswind components greater than 19 knots, in the yellow area labeled DIRECTIONAL.



YELLOW INDICATES CONDITIONS WHERE THE DIRECTIONAL CONTROL MARGIN MAY BE LESS THAN 10% IN ZERO WIND HOVER

DATA BASIS: DERIVED FROM FLIGHT TEST

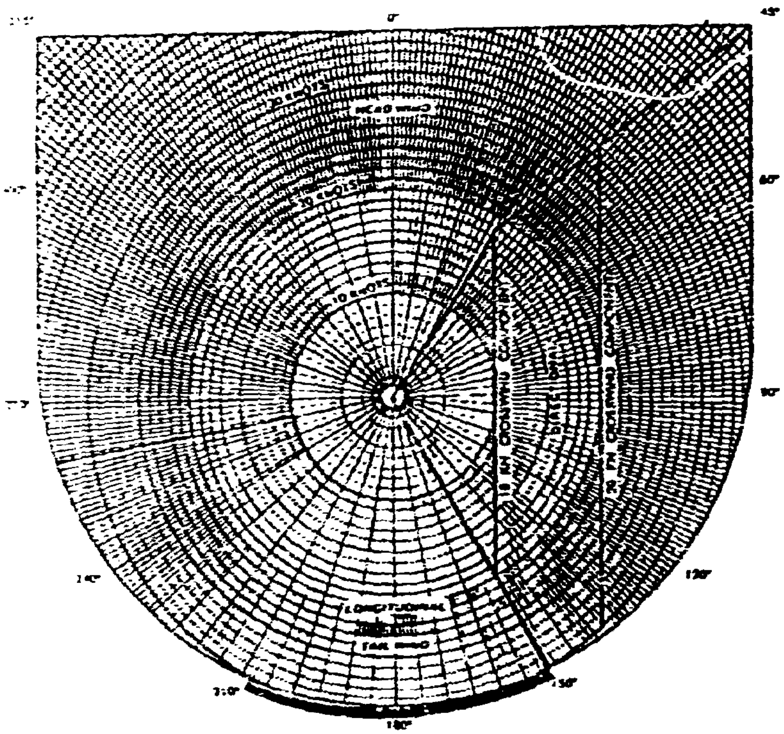
Figure 5-1.1 Directional Control Margin Chart (Sheet 1 of 2)

LONGITUDINAL AND DIRECTIONAL CONTROL MARGIN (IGE TRANSLATIONAL FLIGHT)

CONTROL MARGIN UH-1D/H & EH-1H

YELLOW INDICATES CONDITIONS WHERE THE CONTROL MARGIN MAY BE LESS THAN 10% SEE SHEET 1 FOR GROSS WEIGHTS AND ALTITUDES CORRESPONDING TO CROSSWIND COMPONENTS

RED INDICATES AIRSPEED LIMITS



DATA BASIS DERIVED FROM FLIGHT TEST USA ASTA 66-32 JUNE 1969

Figure 5-13. Longitudinal And Directional Control Margin Chart (Sheet 2 of 2)

UH-1 and AH-1 gross weight validation factor (torque)

[illegible] Perform hover (power) check, in TC 1-135 and TC 1-136 provides the methodology for computation of several different torque values. These computed values, entered on the performance planning card (PPC) and properly used by aircrews, enhance our ability to safely and effectively operate the aircraft.

Some confusion exists with regard to gross weight and its applicability to the go-no-go torque values. The go-no-go values derived for a specific set of environmental conditions are constant, regardless of aircraft gross weight. However, when the indicated torque at a 5-foot hover exceeds the go-no-go value, the only method available to the pilot that will reduce the indicated torque is the reduction of aircraft weight.

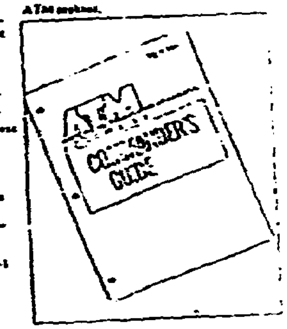
Because go-no-go values do not directly consider aircraft gross weight, they may equate to an aircraft gross weight in excess of the maximum allowable as specified within the operator's manual. For this reason, a gross weight validation factor (torque) should be computed. The gross weight validation factor is computed in the same manner as "predicted torque," except that maximum allowable gross weight is used (i.e., 9,500 pounds - UH-1 and AH-1G; 10,000 pounds - AH-1S).

This torque value should be entered on the PPC and compared to the actual indicated torque during performance of the power check. Indicated torque values above the gross weight validation factor (torque) during the power check denote aircraft gross weight may be in excess of maximum allowable. Weight and balance forms and performance planning figures should be [illegible] aircraft gross weight must be reduced before continuation of the mission.

This gross weight validation factor (torque) has no effect on the go-no-go torque values, and once aircraft gross weight is confirmed, the appropriate go-no-go torque values must be [illegible] to ensure the availability of sufficient engine power.

ATC [illegible]

The Aircrew Training Manual Commander's Guide (TC 1-134) provides guidance for the development of ATM [illegible]. Findings of recent ARMS Team visits have identified several areas of misunderstanding with regard to the purpose and [illegible] of the ATM [illegible].



[illegible]

APPENDIX C

INFLIGHT DATA COLLECTION FORM

AND

TASK RATING SCALE

P ______________________

IP ______________________

ATM VALIDATION DATA COLLECTION FORM

INSTRUCTIONS FOR FINAL CHECKRIDE

1. Aircraft are issued under 986-5 ADP code from Lowe Training Scheduling Branch (255-5835/5917). Log flight under aviator's agency ADP Code with a -5 suffix. Mission code is AM3.

2. Please do not discuss with the aviator his group assignment or flight hours.

3. Have aviator complete the PRE Confidence Rating Scale before the flight. Have him complete Academic Test and then the POST Confidence Rating Scale after the flight.

4. Give aviator feedback about his performance after the POST Confidence Rating Scale has been completed.

   a. Discuss which maneuvers need refresher training in order to meet AAPART standards.

   b. Indicate to aviator that, if he requests, he can have a DA Form 4507-1-R filled out for maneuvers that met AAPART standards during the checkride. Form 4507-1-R will be sent to him within two weeks of the date of the final checkride.

5. POC: Dr. Ruffner, ASI (598-6326); Dr. Bickley (255-2873).

ATM INFLIGHT DATA COLLECTION FORM

NAME ______ (Last) ______ (First) ______ (M.I.) SSN ______

RANK ______ DATE ______ (Day/Month/Year) IP ______

PURPOSE OF FLIGHT: CHK1 | CHK2 | TRNG ITERATION ____ of ____

FLIGHT TIME ______ HOURS WINDS ______ / ______ Direction / Velocity

STAGEFIELD ______

ACADEMIC TEST	
1. PLAN VFR FLT OMISSIONS	1 2 3 4 +
2. WT BAL FORM OMISSIONS	1 2 3 4 +
3. PERF CHARTS OMISSIONS	1 2 3 4 +
4. PREPARE PPC OMISSIONS	1 2 3 4 +
5. FUEL MGT PROCEDURE OMISSIONS	1 2 3 4 +
GROUND/RUN-UP OPNS	
6. PREFLT INSPECT OMISSIONS	1 2 3 4 +
7. BEFORE T/O HIT CHKS OMISSIONS	1 2 3 4 +
8. RADIO PROCEDURE OMISSIONS	1 2 3 4 +
9. AFTER LNDG TASKS OMISSIONS	1 2 3 4 +
HOVER OPNS	
10. T/O TO HOVER	
CLEAR A/C	NO
DRIFT	FWD AFT
	LFT RT
HDG	LFT RT
ALT	LO HI
CONTROL COORD	POOR
11. HOV CHK OMISSIONS	1 2 3 4 +

12. HOV TURN (180°)		
CLEAR A/C	NO	
ALT	LO	HI
DRIFT	FWD	AFT
	LFT	RT
TURN RATE	SLO	FST
	ERRATIC	
13. HOV FLT (50m)		
CLEAR A/C	NO	
ALT	LO	HI
DRIFT	FWD	AFT
	LFT	RT
HDG	LFT	RT
SPEED	SLO	FST
14. LNDG FRM HOVER		
HDG	LFT	RT
DRIFT	FWD	AFT
	LFT	RT
VERT SPEED	SLO	FST
TD	ROUGH	
15. MAN THRT OPN		
T/O RPM	<6300	>6500
3 FT RPM	<6300	>6500
ALT	LO	HI
LFT TURN RPM	<6300	>6500
RT TURN RPM	<6300	>6500
LNDG RPM	<6300	>6500
THROTTLE RATE	SLO	FST
DRIFT	FWD	AFT
	LFT	RT

2

ENG FAIL STAT HOV		
HDG	LFT	RT
DRIFT	FWD	AFT
	LFT	RT
TD COORD	POOR	
HOV AUTO		
HDG	LFT	RT
DRIFT	FWD	AFT
	LFT	RT
TD COORD	POOR	
18 SLOPE OPNS		
HDG	LFT	RT
DRIFT	FWD	AFT
	LFT	RT
DESCENT	ROUGH	
ASCENT	ROUGH	
CONTROL COORD	POOR	

IN-TRAFFIC

19 TRAF PAT		
CLIMBOUT		
CLIMB RATE	SLO	FST
A/S	SLO	FST
GROUND TRACK	LFT	RT
TRIM NEEDS (PED)	LFT	RT
X-WIND		
CLIMB RATE	SLO	FST
A/S	SLO	FST
GROUND TRACK	LFT	RT
TRIM NEEDS (PED)	LFT	RT
ALT	LO	HI
BASE		
DESCENT RATE	SLO	FST
A/S	SLO	FST
GROUND TRACK	LFT	RT
TRIM NEEDS (PED)	LFT	RT
ALT	LO	HI
FINAL		
GROUND TRACK	LFT	RT
20 CLIMB/DESCEND		
CLEAR A/C	NO	
A/S	SLO	FST
TRIM NEEDS (PED)	LFT	RT
CLIMB RATE	SLO	FST
DESCENT RATE	SLO	FST
HDG	LFT	RT
GROUND TRACK	LFT	RT

21. TURNS		
CLEAR A/C	NO	
A/S	SLO	FST
TRIM NEEDS (PED)	LFT	RT
BANK ANGLE	SHL	STP
AVG TURN RATE	SLO	FST
ROLLOUT HDG	LFT	RT
22. STRT/LVL FLT		
A/S	SLO	FST
TRIM NEEDS (PED)	LFT	RT
ALT	LO	HI
HDG	LFT	RT
GROUND TRACK	LFT	RT

TAKEOFFS

23. NORM T/O		
CLEAR A/C	NO	
PRE-ETL ALT	LO	HI
DRIFT	LFT	RT
PRE-ETL POWER	INSF	EXSV
PRE-ETL HDG	LFT	RT
ATTITUDE	LO	HI
CLIMB RATE	SLO	FST
ACCEL	SLO	FST
24 SIM MAX T/O		
POWER CHK	NO	
POWER	INSF	EXSV
HDG	LFT	RT
GROUND TRACK	LFT	RT
ATTITUDE	LO	HI
TRANSITION PT	EARLY	LATE

APPROACHES

25. BEFORE LNDG CHKS		
OMISSIONS	1 2 3 4 +	
26. NORM APPROACH		
ENTRY ALT	LO	HI
ENTRY A/S	SLO	FST
APPROACH ANGLE	SHL	STP
TRIM NEEDS (PED)	LFT	RT
CLOS RATE	SLO	FST
RNWY ALIGN	LFT	RT
TD	ROUGH	
27. STEEP APPROACH		
ENTRY ALT	LO	HI
ENTRY A/S	SLO	FST
APPROACH ANGLE	SHL	STP
TRIM NEEDS (PED)	LFT	RT
CLOS RATE	SLO	FST
RNWY ALIGN	LFT	RT
TD	ROUGH	

3.

28. SHL APPRCH RNG LNDG		
ENTRY ALT	LO	HI
ENTRY A/S	SLO	FST
APPROACH ANGLE	SHL	STP
TRIM NEEDS (PED)	LFT	RT
CLOS RATE	SLO	FST
RNWY ALIGN	LFT	RT
TD	ROUGH	
29. HYD FAILURE		
EMER PROCEDURE	INCRT	
A/S	SLO	FST
RNWY ALIGN	LFT	RT
APPROACH ANGLE	SHL	STP
TRIM NEEDS (PED)	LFT	RT
CLOS RATE	SLO	FST
TD SPEED	SLO	FST
TD PT	SHT	LNG
TD COORD	POOR	
30. ANTITRQ MALF (L)		
THRTL/SLK RED AMT	INSF	EXSV
ENTRY ALT	LO	HI
ENTRY A/S	SLO	FST
RNWY ALIGN	LFT	RT
CLOS RATE	SLO	FST
TD/HDG COORD	POOR	
TD COORD	POOR	
31. ANTITRQ MALF (R)		
THRTL/SLK RED AMT	INSF	EXSV
ENTRY ALT	LO	HI
ENTRY A/S	SLO	FST
RNWY ALIGN	LFT	RT
CLOS RATE	SLO	FST
TD/HDG COORD	POOR	
TD COORD	POOR	
32. GO-AROUND		
POWER	INSF	EXSV
A/S	SLO	FST
GROUND TRACK	LFT	RT
TRIM NEEDS (PED)	LFT	RT
33 STD AUTO		
ENTRY ALT	LO	HI
ENTRY A/S	SLO	FST
TRIM NEEDS (PED)	LFT	RT
DESCENT A/S	SLO	FST
DECEL	INSF	EXSV
INITIAL PITCH	INSF	EXSV
CSHN PITCH COORD	POOR	
TD COORD	POOR	
TD DRIFT	LFT	RT
GROUND SLIDE	EXSV	
GROUND TRACK	LFT	RT
TD PT	SHT	LNG

34. L/L AUTO		
ENTRY ALT	LO	HI
ENTRY A/S	SLO	FST
ENTRY COORD	POOR	
DECEL	INSF	EXS
INITIAL PITCH	INSF	EXS
CSHN PITCH COORD	POOR	
TD COORD	POOR	
TD DRIFT	LFT	RT
GROUND SLIDE	EXSV	
TD PT	SHT	LNG

OUTSIDE TRAFFIC

36. DECEL/ACCEL		
ALT	LO	HI
A/S CONTROL	POOR	
HDG/GROUND TRACK	LFT	RT
TRIM NEEDS (PED)	LFT	RT
37. ENG FAIL AT ALT		
ENTRY COORD	POOR	
RADIO PROCEDURE	POOR	
MANEUVER COORD	POOR	
RECOVERY COORD	POOR	
38. HI RECON		
ALT	LO	HI
A/S	SLO	FS
OPERATION PLAN	POOR	
39. CNFD AREA OPNS		
ENTRY ALT	LO	HI
ENTRY A/S	SLO	FS
APPROACH ANGLE	SHL	ST
CLOS RATE	SLO	FS
TERMINATION	POOR	
T/O PLAN	POOR	
POWER CHK	NO	
HDG	LFT	RT
GROUND TRACK	LFT	RT
POWER	INSF	EX
COORD	POOR	

40. MTN/RDGLN OPNS		
ENTRY ALT	LO	HI
ENTRY A/S	SLO	FST
APPROACH ANGLE	SHL	STP
CLOS RATE	SLO	FST
TERM	POOR	
T/O PLAN	POOR	
HDG	LFT	RT
GROUND TRACK	LFT	RT
ALT	LO	HI
POWER	INSF	EXSY
COORD	POOR	
TACTICAL OPNS		
41. TER FLT MSN PLAN		
OMISSIONS	1 2 3 4 +	
42. TER FLT NAV		
ENROUTE NAV ACCURACY	>200m	
MISSED CHKPTS	1 2 3 4 +	
LOC FINAL OBJ	NO	
43. L/L FLT		
A/S	SLO	FST
ALT	LO	HI
ARV TIMES	EARLY	LATE
REPORT CHKPTS	POOR	
44. NOE FLT		
A/S	SLO	FST
OBSTACLE CLRNCE	LO	HI
REPORT CHKPTS	POOR	
45. NOE DECEL		
HDG	LFT	RT
TAILRTR ALT	LO	HI
TERM PT	SHT	LNG
CONTROL COORD	POOR	
46. TER FLT APPROACH		
APPROACH ANGLE	SHL	STP
CLOS RATE	SLO	FST
HDG	LFT	RT
CONTROL COORD	POOR	
47. OGE CHECK		
POWER CHK	NO	
ALT	LO	HI
360° TURN	SLO	FST
DRIFT	FWD	AFT
	LFT	RT
CONTROL COORD	POOR	
48. TER FLT T/O		
POWER CHK	NO	
POWER APPLICATION	INSF	EXSY
GROUND TRACK	LFT	RT
TRANSITION COORD	POOR	

ATM VALIDATION MANEUVER RATING SCALE

RATING	DESCRIPTION
1	Performance unsafe to the extent that the IP immediately had to take control of the aircraft.
2	Performance deteriorated until IP was finally required to take control of the aircraft.
3	Few of the ATM standards were met, student required considerable verbal assistance but IP did not have to take control of the aircraft.
4	Less than half of the ATM standards were met, student required some verbal assistance and continually over/under controlled.
5	Less than half of the ATM standards were met, required little verbal assistance but frequently over/under controlled.
6	Majority of the ATM standards were met, student required little or no verbal assistance, but tended to occasionally over-control or accepted slight deviations while attempting corrections.
7	Majority of the ATM standards were met, little or no verbal assistance needed, performance generally smooth but occasionally over-controlled or was slow making necessary corrections.
8	All ATM standards were met, most deviations from desired state were quickly noticed and smoothly corrected.
9	All ATM standards were met, all deviations from desired state were immediately noticed and smoothly corrected.
10	All ATM standards were met. Majority of performance within IP standards.
11	All performance within IP standards, any deviations from desired state were small and immediately corrected.
12	Outstanding. No noticeable deviations from desired performance.

APPENDIX D

CONFIDENCE RATING SCALE

POST

SSN ______________________

NAME ______________________ Tr ______________________ DATE ______________

CONFIDENCE RATING SCALE

INSTRUCTIONS: Place a slash (/) through the horizontal line located below each ATM task to indicate the amount of <u>confidence</u> you have in your ability to perform that task to ATM standards.

Plan a VFR Flight

Low Confidence |————————————————| High Confidence

Prepare DD Form 365F (Weight and Balance)

Low Confidence |————————————————| High Confidence

Use Performance Charts

Low Confidence |————————————————| High Confidence

Prepare Performance Planning Card (PPC)

Low Confidence |————————————————| High Confidence

Perform Preflight Inspection

Low Confidence |————————————————| High Confidence

Perform Before-Takeoff Checks

Low Confidence |————————————————| High Confidence

Perform Radio Communications Procedures

Low Confidence |————————————————| High Confidence

Perform Takeoff to a Hover

Low Confidence |————————————————| High Confidence

Perform Hover (Power) Checks

Low Confidence |————————————————| High Confidence

Perform Hovering Turns

Low Confidence |————————————————| High Confidence

Perform Hovering Flight

Low Confidence |————————————————| High Confidence

Perform Normal Takeoff

Low Confidence |————————————————| High Confidence

Perform Climbs and Descents

Low Confidence |————————————————| High Confidence

ARI FR 15-42A

Perform Turns

Low Confidence |————————————————| High Confidence

Perform Straight-and-Level Flight

Low Confidence |————————————————| High Confidence

Perform Fuel Management Procedures

Low Confidence |————————————————| High Confidence

Perform Deceleration/Acceleration

Low Confidence |————————————————| High Confidence

Navigate by Pilotage and Dead Reckoning (DR)

Low Confidence |————————————————| High Confidence

Perform Before-Landing Checks

Low Confidence |————————————————| High Confidence

Perform Traffic Pattern Flight

Low Confidence |————————————————| High Confidence

Perform Normal Approach

Low Confidence |————————————————| High Confidence

Perform Landing From a Hover

Low Confidence |————————————————| High Confidence

Perform Simulated Maximum Performance Takeoff

Low Confidence |————————————————| High Confidence

Perform Steep Approach

Low Confidence |————————————————| High Confidence

Perform Shallow Approach to a Running Landing

Low Confidence |————————————————| High Confidence

Perform Simulated Hydraulic System Malfunction

Low Confidence |————————————————| High Confidence

Perform Manual Throttle Operation, Emergency Governor Mode

Low Confidence |————————————————| High Confidence

Perform Simulated Antitorque Malfunction (Fixed Pedal Settings)

Low Confidence |————————————————| High Confidence

Perform Go-Around

Low Confidence ———————— High Confidence

Perform Simulated Engine Failure From Hover Altitude

Low Confidence ———————— High Confidence

Perform Hovering Autorotations

Low Confidence ———————— High Confidence

Perform Standard Autorotation

Low Confidence ———————— High Confidence

Perform Low-Level Autorotation

Low Confidence ———————— High Confidence

Perform Standard Autorotation With a 180-Degree Turn

Low Confidence ———————— High Confidence

Perform Simulated Engine Failure at Altitude

Low Confidence ———————— High Confidence

Perform High Reconnaissance

Low Confidence ———————— High Confidence

Perform Confined Area Operations

Low Confidence ———————— High Confidence

Perform Slope Operations

Low Confidence ———————— High Confidence

Perform Pinnacle/Ridgeline Operations

Low Confidence ———————— High Confidence

Perform After-Landing Tasks

Low Confidence ———————— High Confidence

Perform Terrain Flight Mission Planning

Low Confidence ———————— High Confidence

Perform Terrain Flight Navigation

Low Confidence ———————— High Confidence

Perform Low-Level Flight

Low Confidence ———————— High Confidence

Perform Contour Flight

Low Confidence ———————— High Confidence

Perform NOE Flight

Low Confidence ———————— High Confidence

Perform NOE Deceleration

Low Confidence ———————— High Confidence

Perform Terrain Flight Approach

Low Confidence ———————— High Confidence

Perform Out-of-Ground Effect (OGE) Check

Low Confidence ———————— High Confidence

Perform Terrain Flight Takeoff

Low Confidence ———————— High Confidence

APPENDIX E

WEIGHT AND BALANCE PRACTICE EXERCISES

WEIGHT AND BALANCE CLEARANCE FORM F
TRANSPORT
(SEE REVERSE FOR TACTICAL MISSIONS)

Date	Aircraft Type	From	Home Station
19 July 82	UH-1H	OZR	OZR

Serial No.	To	Pilot
64-13789	—	Hamblin, B

Limitations	Takeoff	Landing
Allowable gross weight	9500	9500

Ref	Item	Weight	Moment
1	Basic aircraft	5199	7903
2	Oil 3.25 20 lbs	27	
3	Crew 2	370	

Complete the underlined items.

Exercise #1

DD FORM 365F

WEIGHT AND BALANCE CLEARANCE FORM F
TRANSPORT
(SEE REVERSE FOR TACTICAL MISSIONS)

Date	Aircraft Type	From	Home Station
19 Jul 82	UH-1H.	OZR	OZR

Serial No.	To	Pilot
69-13479	—	Glenn J

Ref	Item	Weight
1	Basic aircraft	5145
2	Oil 3.25 (20 lbs)	27
3	Crew 2	370

Landing fuel weight: 476

Compt	No.	Weight	Cargo
C	4	96	Troops
C	1	200	CE

Complete the underlined items. Crew Chief in Station #7.

Exercise #2

NOTE—THIS TRANSPORT CLEARANCE FORM HAS RESULTED FROM TRIPARTITE AGREEMENT AND NO FURTHER CHANGES MAY BE MADE TO IT WITHOUT PRIOR CONSIDERATION BY TRIPARTITE AUTHORITIES.

DD FORM 365F

WEIGHT AND BALANCE CLEARANCE FORM F
TRANSPORT
(SEE REVERSE FOR TACTICAL MISSIONS)

Aircraft type	UH-1H
Serial no.	67-15880
From	OZR
To	NBU
Home station	STL
Pilot	Jones B.

	Item	Weight	Moment
1	Basic aircraft	5180	7395
2	Oil	27	7
3	Crew (no.) 2	3710	
9	Takeoff fuel	1130	

Takeoff fuel: 1500 [uncertain]

Compartment loads: 2 / 1 / 200; 4 / 2 / 400

Complete the underlined items.

Exercise # 3

Signature: Bob Jones [uncertain]

NOTE—THIS TRANSPORT CLEARANCE FORM HAS RESULTED FROM TRIPARTITE AGREEMENT AND NO FURTHER CHANGES MAY BE MADE TO IT WITHOUT PRIOR CONSIDERATION BY TRIPARTITE AUTHORITIES

WEIGHT AND BALANCE CLEARANCE FORM F
TRANSPORT
(SEE REVERSE FOR TACTICAL MISSIONS)

Date	21 July 82
Aircraft type	UH-1
Serial no.	65-15432
From	NBU
To	STL
Home station	OZR

	Item	Weight	Moment
1	Basic aircraft	5174	7740
2	Oil	27	
3	Crew (no.) 2	400	
8	Operating weight	5721	
9	Takeoff fuel	1159	

Takeoff fuel: 734

Compartment loads: 2 / 200; 500

Complete the underlined items.

Exercise # 4

NOTE—THIS TRANSPORT CLEARANCE FORM HAS RESULTED FROM TRIPARTITE AGREEMENT AND NO FURTHER CHANGES MAY BE MADE TO IT WITHOUT PRIOR CONSIDERATION BY TRIPARTITE AUTHORITIES

WEIGHT AND BALANCE CLEARANCE FORM F
TRANSPORT
USE REVERSE FOR TACTICAL MISSIONS

Date: 21 July 82
Aircraft type: UH-1
From: OZR
Home station: OZR
Serial no.: 66-12645

Limitations — Takeoff: 9500

Item		Weight	Moment
1	Basic aircraft	4725	7425
2	Oil 3.25	27	
3	Crew 2	325	
9	Takeoff fuel 200 JP4	1560	1760

Planned fuel weight: 525

Distribution of allowable load: 4 4 200

Complete the underlined items.

Exercise #5

DD Form 365F

WEIGHT AND BALANCE CLEARANCE FORM F
TRANSPORT
USE REVERSE FOR TACTICAL MISSIONS

Date: 21 July 82
Aircraft type: UH-1
From: LOR
To: OZR
Home station: OZR
Serial no.: 67-16573

Limitations — Takeoff: 9500

Item		Weight	Moment
1	Basic aircraft	5095	
2	Oil 3.25	27	
3	Crew 2 @ 200		
9	Takeoff fuel 200 JP4		

Planned fuel weight: 496

Distribution of allowable load:
6 1 200
6 1 180

Complete the underlined items.

Exercise #6

DD Form 365F

APPENDIX F

DESCRIPTION OF PROCEDURE USED TO NORMALIZE RAW SCORE DATA

The procedure used in this research to normalize the raw score data is based on a method for converting ordinal data to interval data. It is described in Hays' (1967) text Quantification in Psychology on pages 39-42. The procedure makes the assumption that the true values of aviator performance on the tasks are normally distributed.

In this experiment IPs rated the checkride performance of subjects on each of the 47 tasks by using a 1 through 12 rating scale (see Figure 1). The observed performance on each task was placed in one of the twelve successive categories of the rating scale. The categories are successive in the sense that they form a logical progression from the lowest (1) to the highest (12) proficiency. The following steps are then followed for all initial and final checkride scores given by each IP.

- Determine the number of times the IP uses each of the 12 raw score categories across all tasks.
- Convert the total number of scores assigned to a category to a proportion of the total scores given by the IP.
- Determine the cumulative proportion of scores for each category.
- Find the point (z score) on the normal distribution that corresponds to the cumulative proportion of scores at the lower and upper limit of each of the categories.
- Using a table of normal distribution densities and areas, find the mean z-score value for each of the categories using the formula:

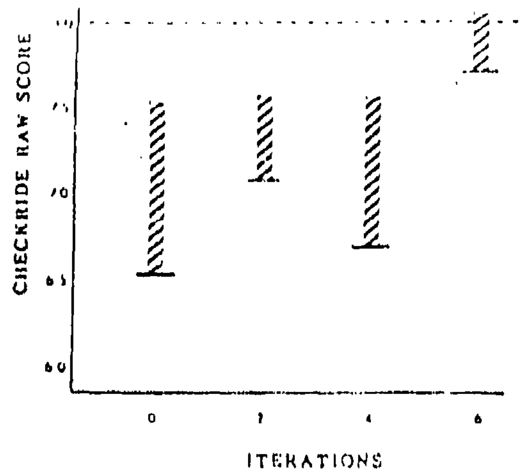
$$\text{mean of category} = \frac{\text{(density at lower limit)} - \text{(density at upper limit)}}{\text{(area below upper limit)} - \text{(area below lower limit)}}$$

- The mean value for a category is the normalized score for that category. It is substituted for the corresponding raw score.

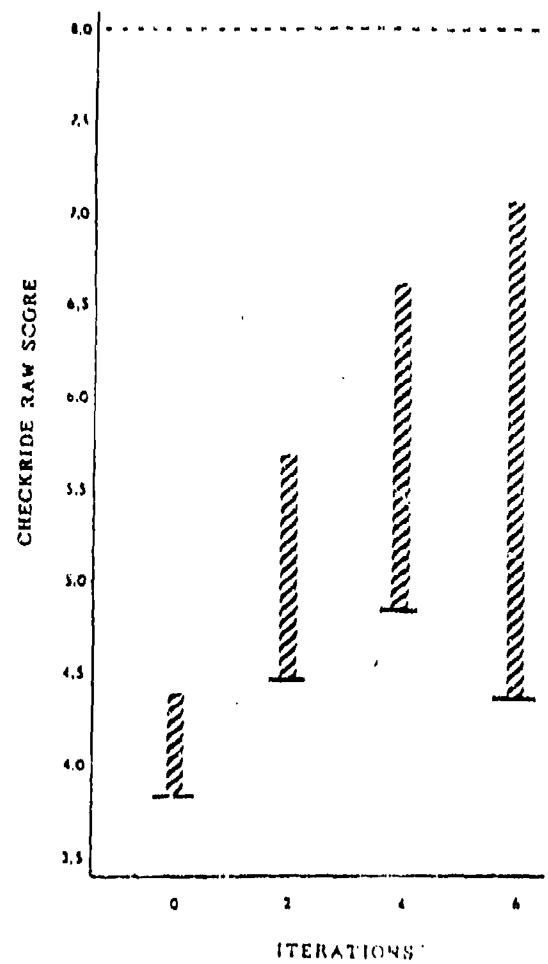
APPENDIX G

GRAPHICAL PRESENTATION OF INITIAL TO FINAL
CHECKRIDE CHANGES FOR RAW SCORE ITERATION GROUP MEANS

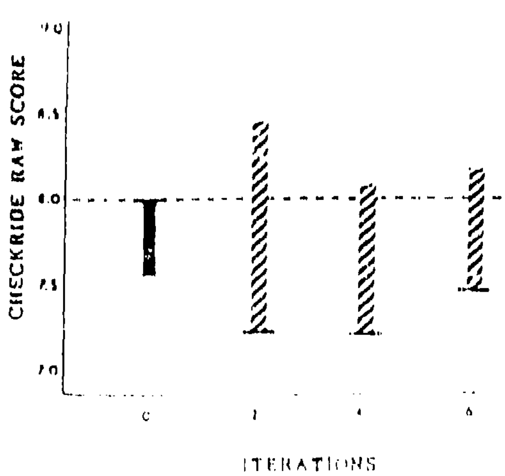
1. PLAN VFR Flight



2. PREPARE WEIGHT AND BALANCE FORM

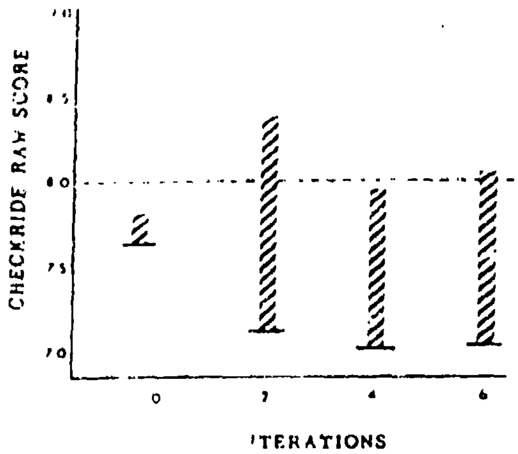


3. USE PERFORMANCE CHART

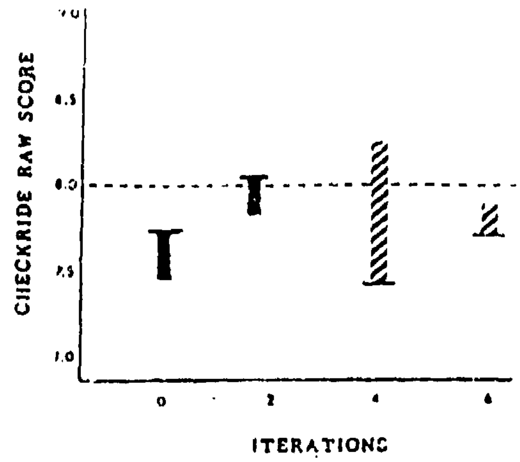


Note: = Decrease from Initial Checkride; = Increase from Initial Checkride.

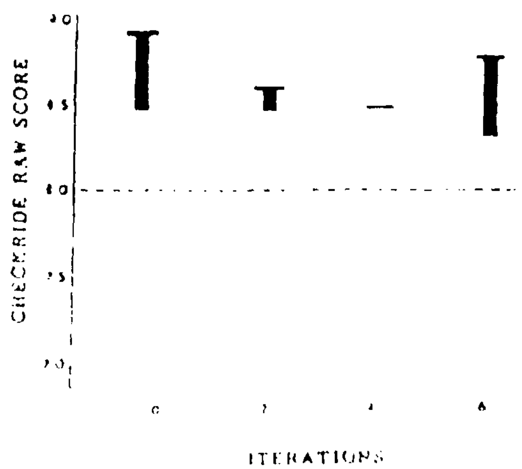
4. PREPARE PERFORMANCE PLANNING CARD



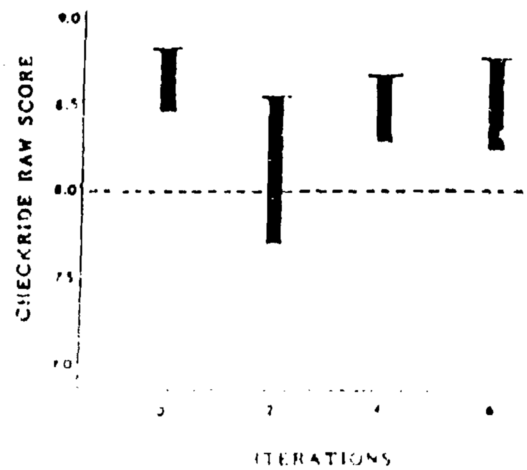
5. FUEL MANAGEMENT PROCEDURES



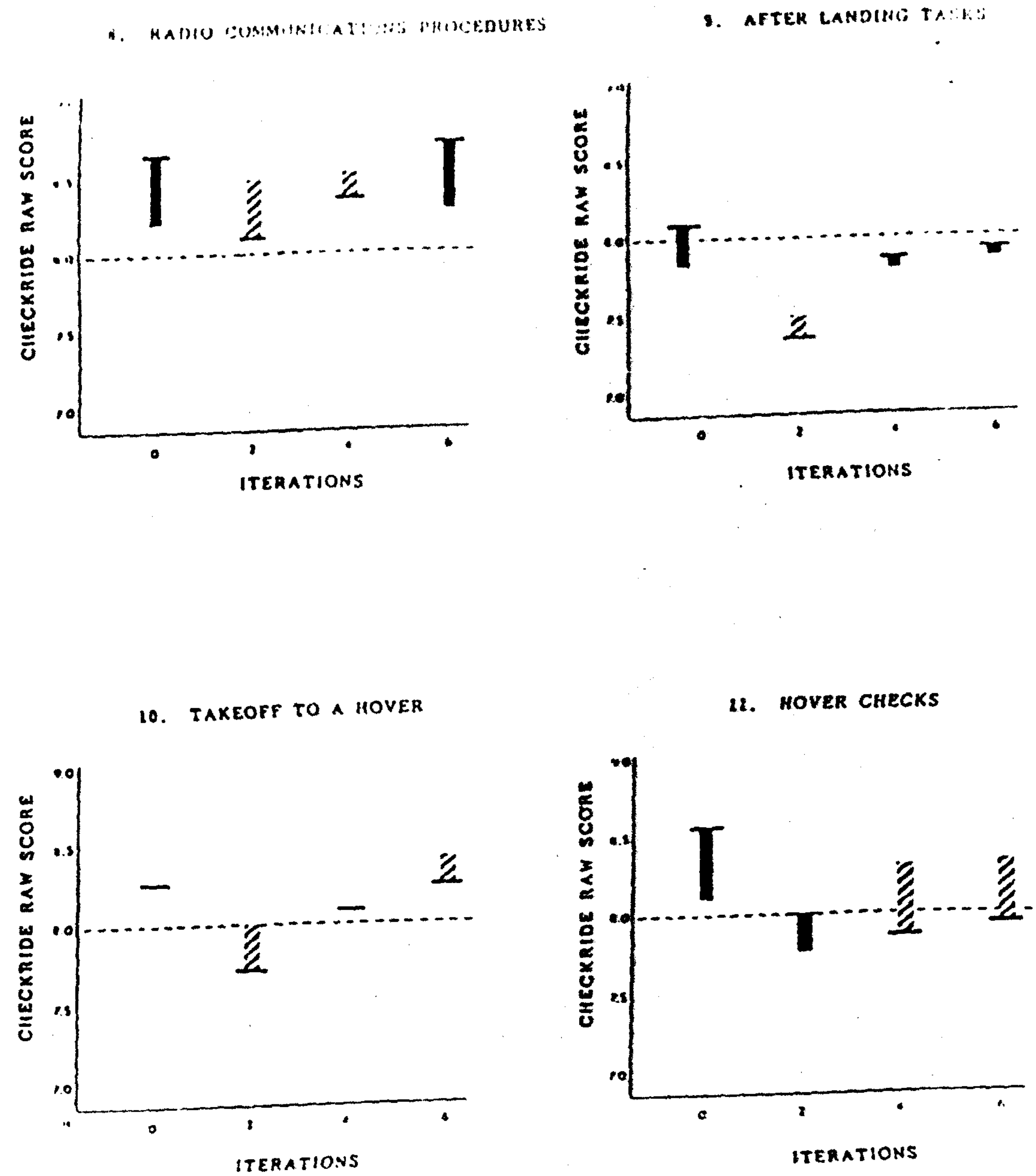
6. PREFLIGHT INSPECTION



7. BEFORE TAKEOFF CHECKS

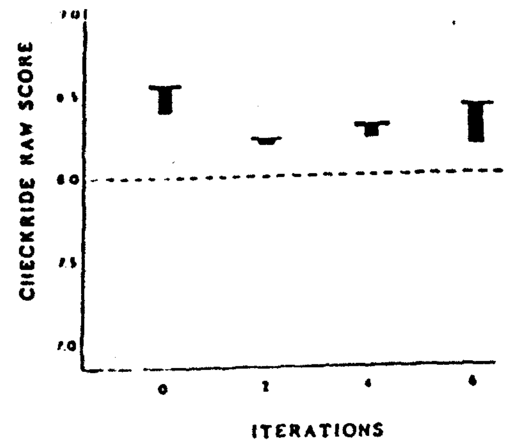


Note: = Decrease from Initial Checkride = Increase from Initial Checkride

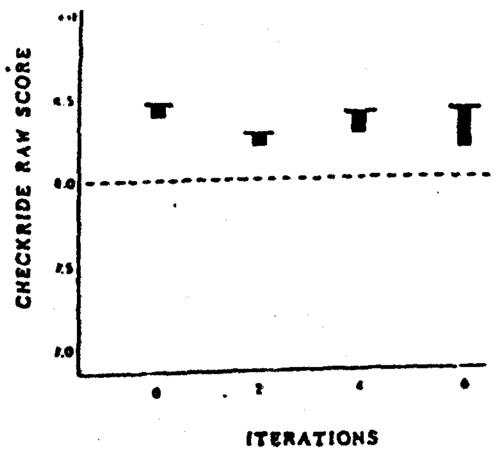


Note. = Decrease from Initial Checkride; = Increase from Initial Checkride.

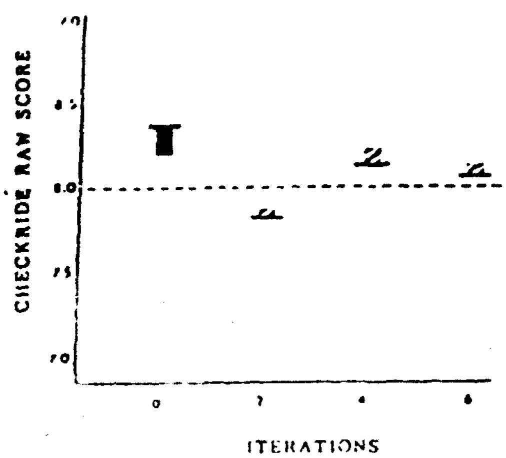
12. HOVERING TURN



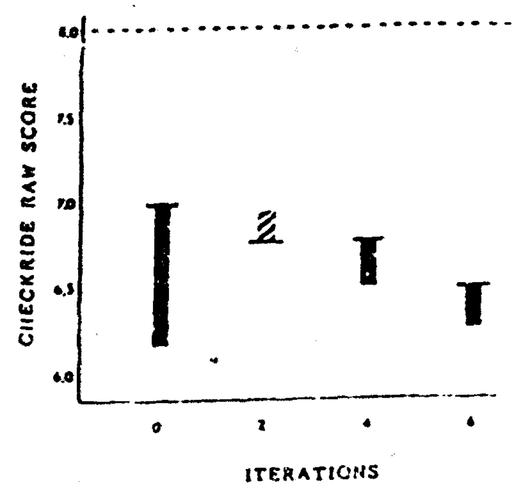
13. HOVERING FLIGHT



14. LANDING FROM A HOVER

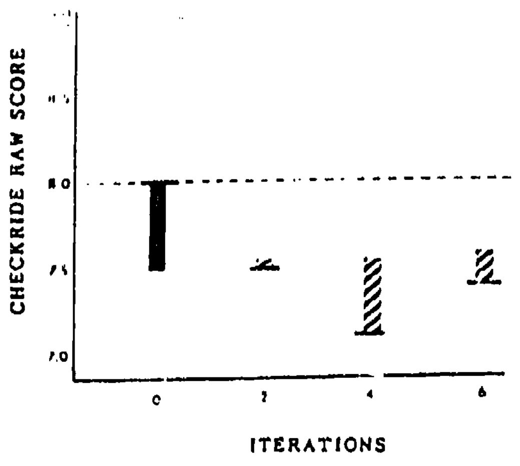


15. MANUAL THROTTLE OPERATION

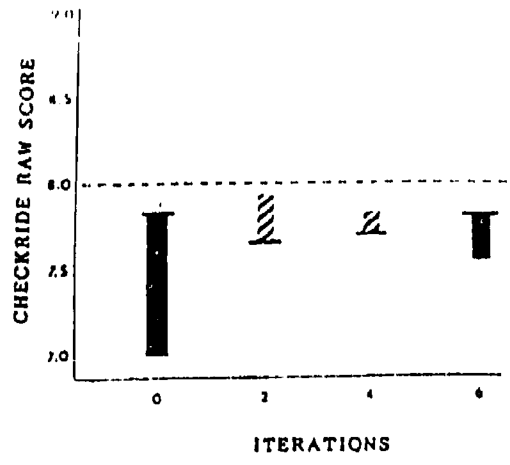


Note. = Decrease from Initial Checkride; = Increase from Initial Checkride.

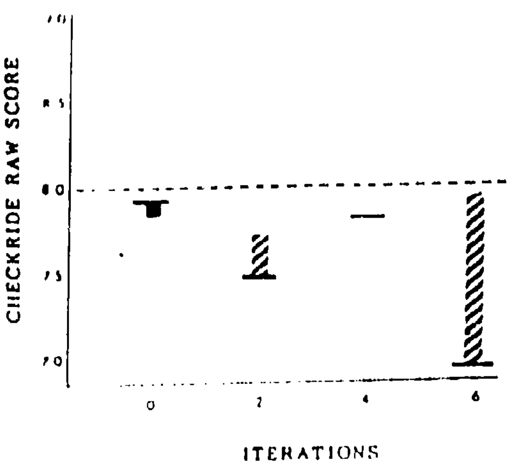
16. ENGINE FAILURE AT A HOVER



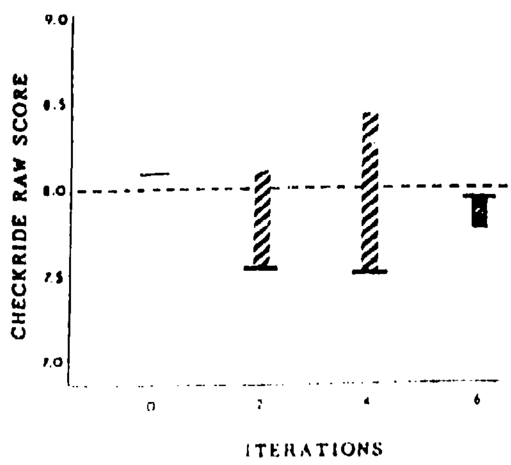
17. HOVERING AUTOROTATION



18. SLOPE OPERATIONS

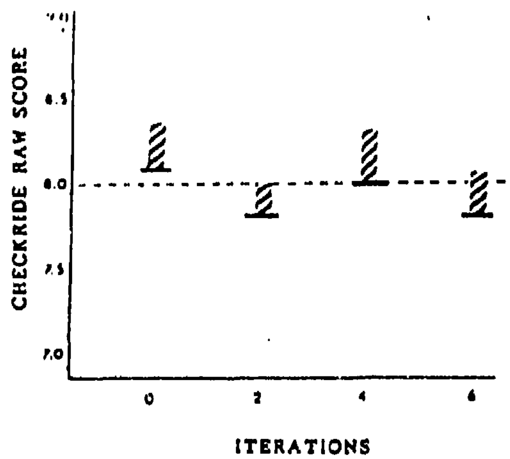


19. TRAFFIC PATTERN

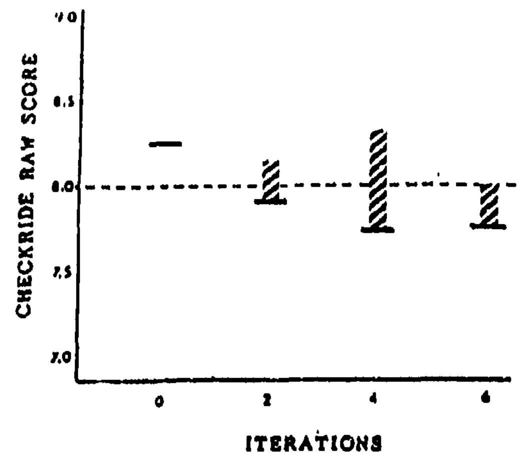


Note. = Decrease from Initial Checkride. = Increase from Initial Checkride.

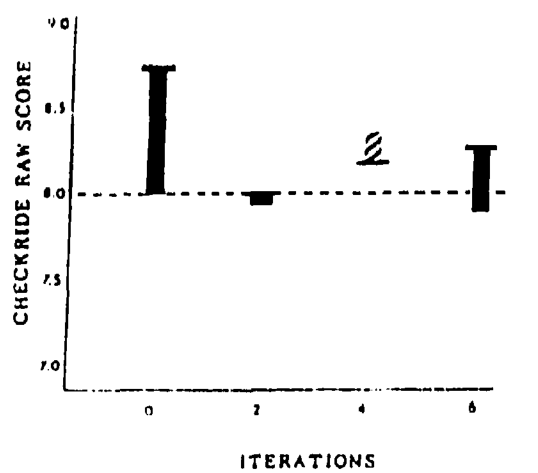
20. CLIMB/DESCEND



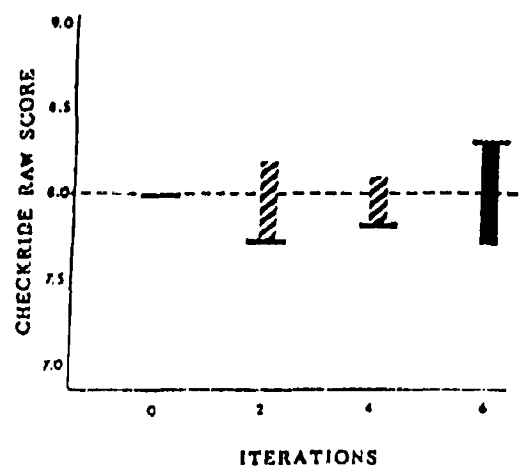
21. TURNS



22. STRAIGHT AND LEVEL FLIGHT

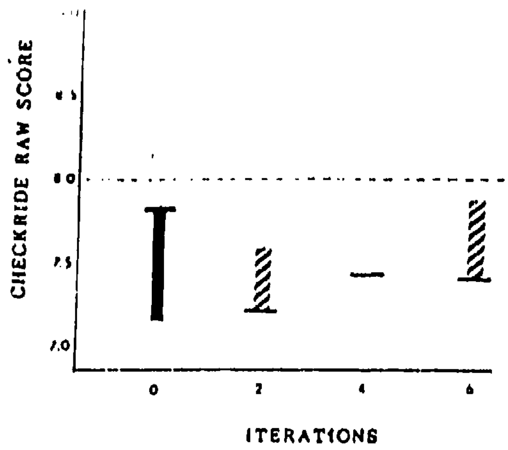


23. NORMAL TAKEOFF

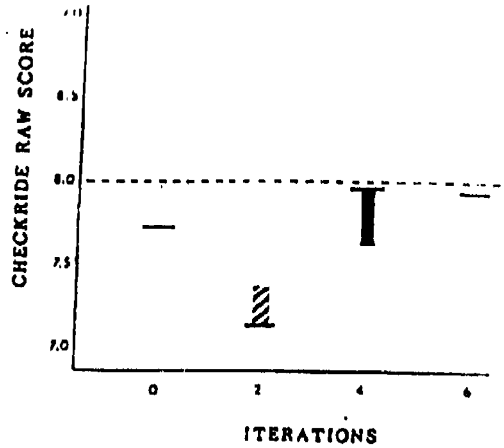


Note. = Decrease from Initial Checkride; = Increase from Initial Checkride.

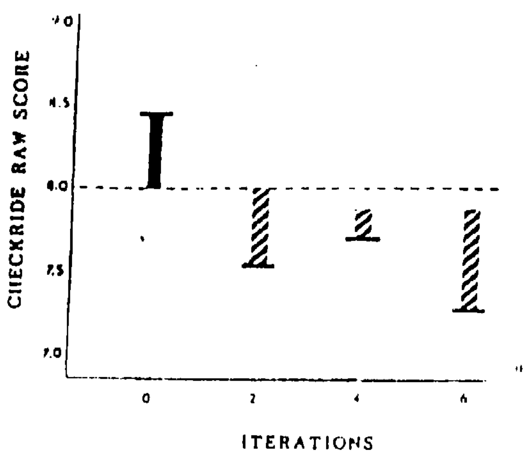
24. MAXIMUM PERFORMANCE TAKEOFF



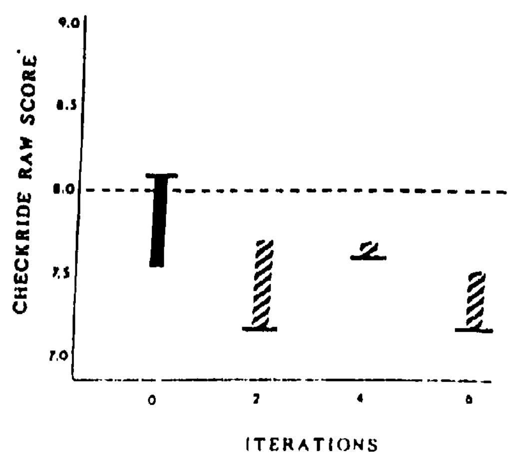
25. BEFORE LANDING CHECKS



26. NORMAL APPROACH

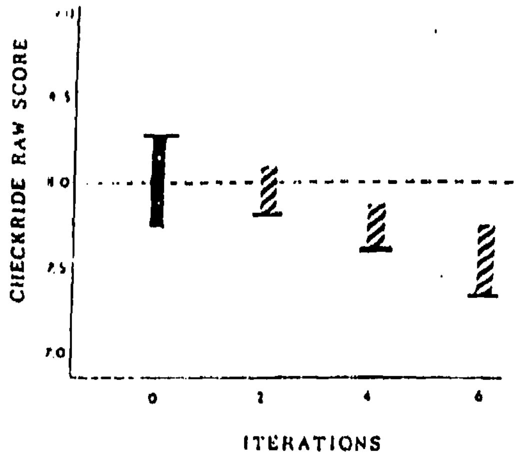


27. STEEP APPROACH

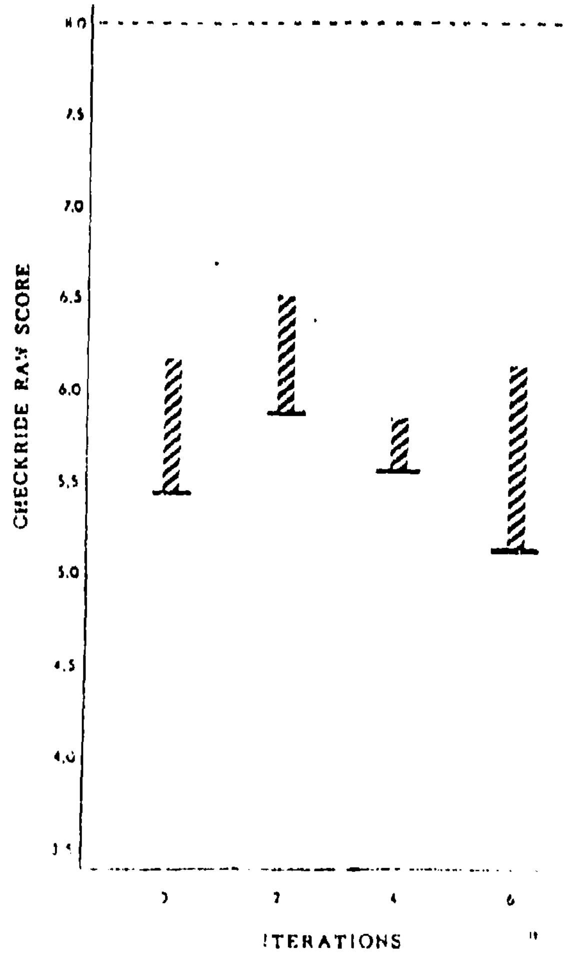


Note. ▮ = Decrease from Initial Checkride; ▨ = Increase from Initial Checkride.

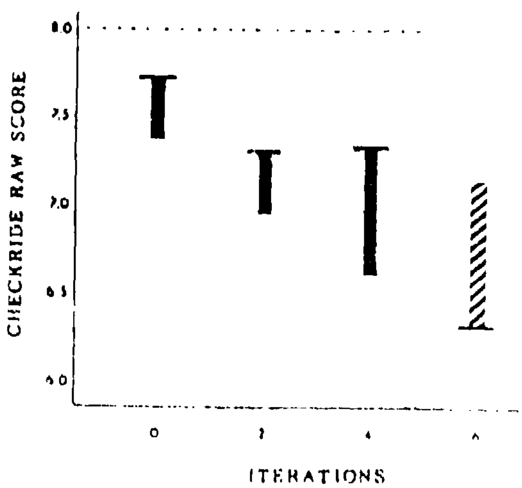
28. SHALLOW APPROACH TO A RUNNING LANDING



29. HYDRAULICS FAILURE

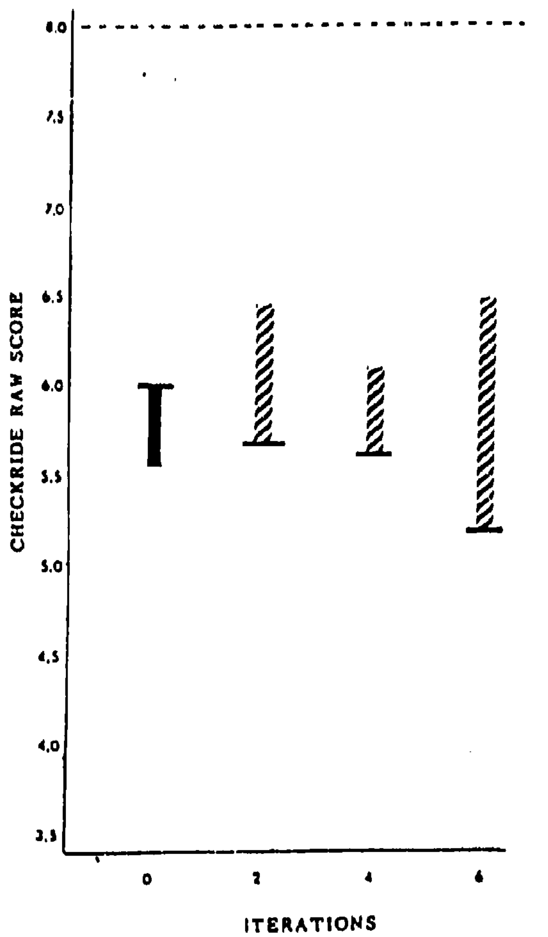


30. ANTITORQUE FAILURE--LEFT PEDAL

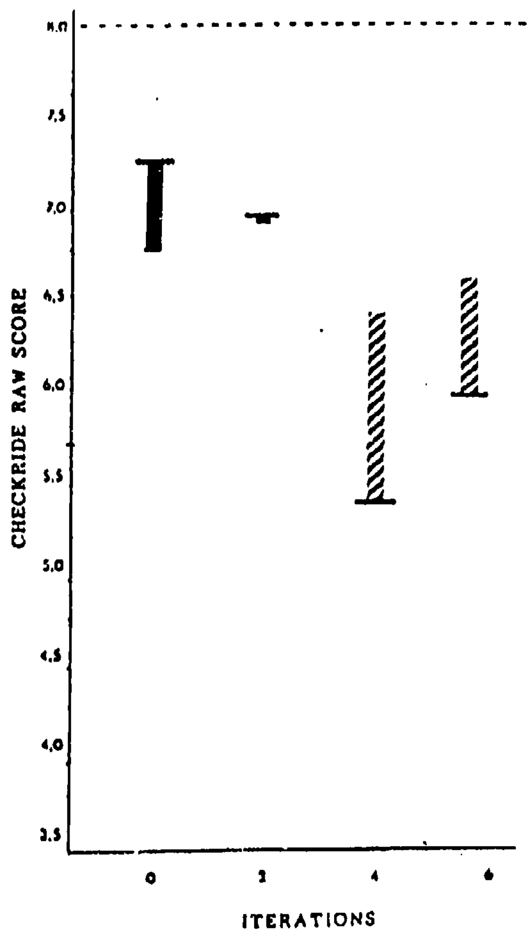


Note = Decrease from Initial Checkride; = Increase from Initial Checkride.

31. ANTITORQUE FAILURE--RIGHT PEDAL

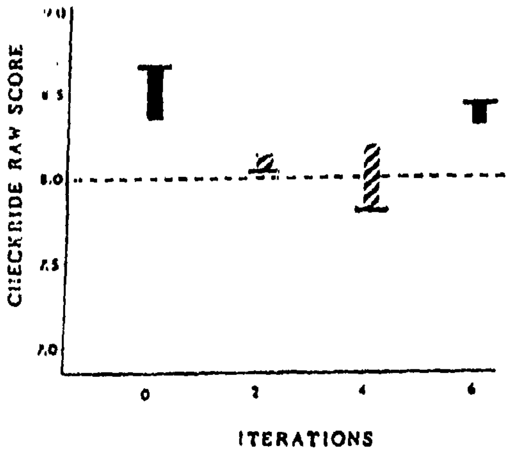


33. STANDARD AUTOROTATION

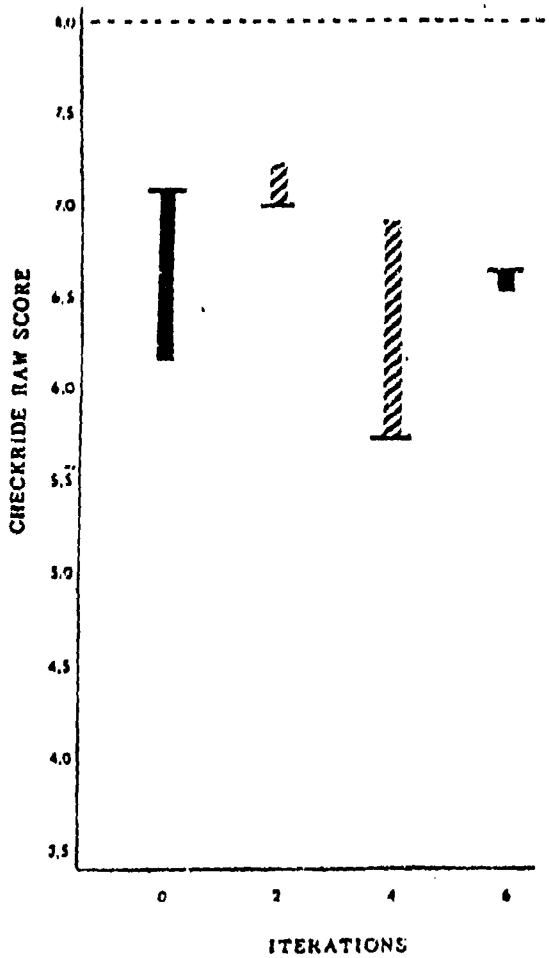


Note. = Decrease from Initial Checkride; = Increase from Initial Checkride.

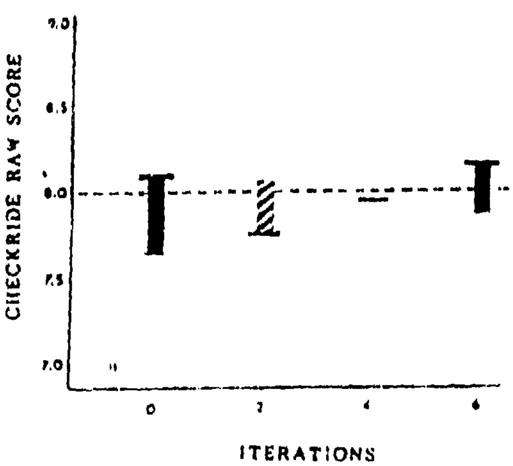
32. GO-AROUND



34. LOW LEVEL AUTOROTATION

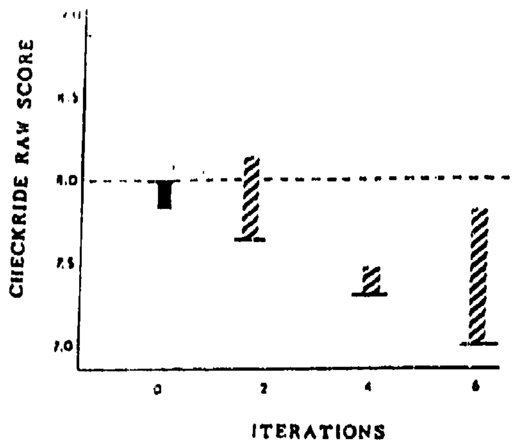


36. DECELERATION/ACCELERATION

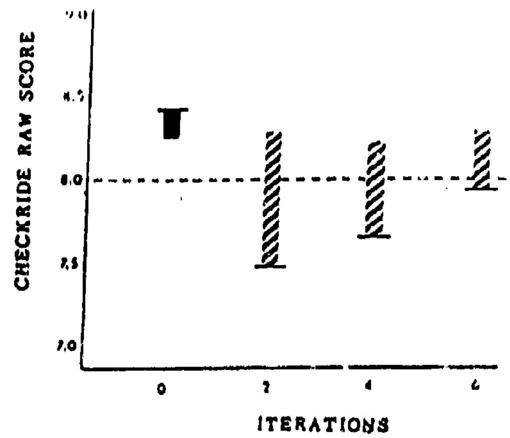


Note. = Decrease from Initial Checkride; = Increase from Initial Checkride.

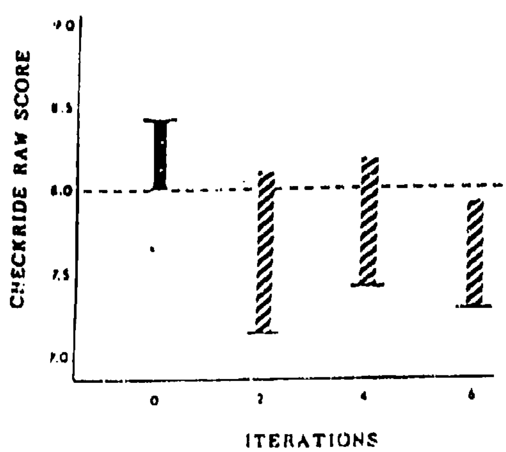
37. ENGINE FAILURE AT ALTITUDE



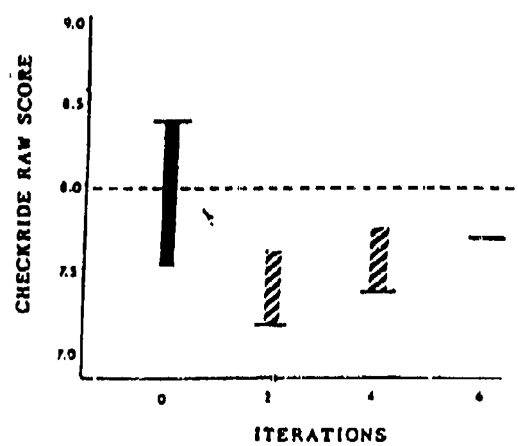
38. HIGH RECONNAISSANCE



39. CONFINED AREA OPERATIONS

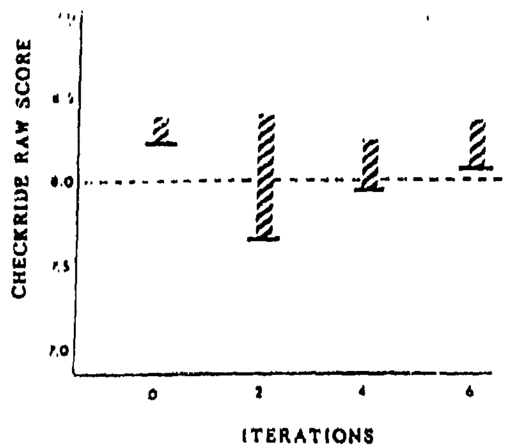


40. PINNACLE/RIDGELINE OPERATIONS

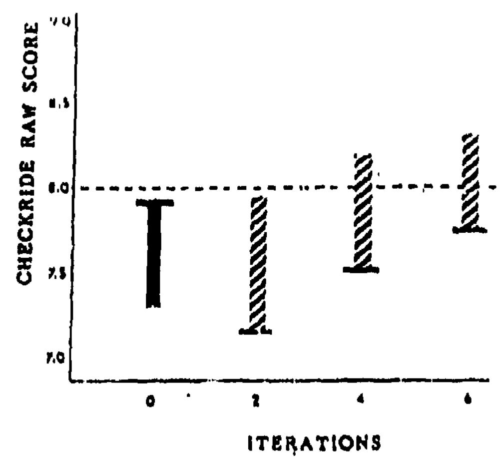


Note. = Decrease from Initial Checkride; = Increase from Initial Checkride.

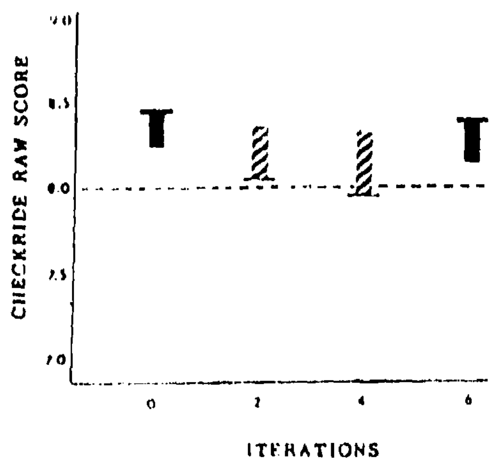
41. TERRAIN FLIGHT MISSION PLANNING



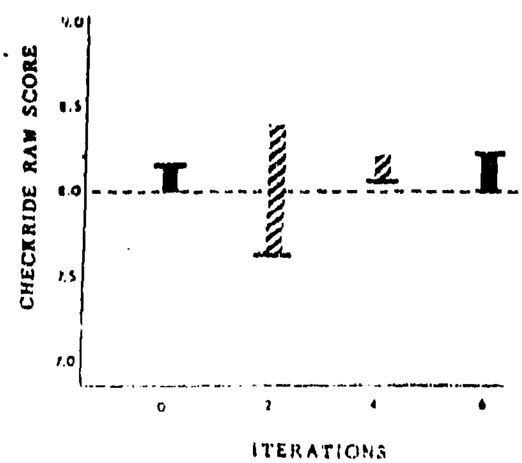
42. TERRAIN FLIGHT NAVIGATION



43. LOW-LEVEL FLIGHT

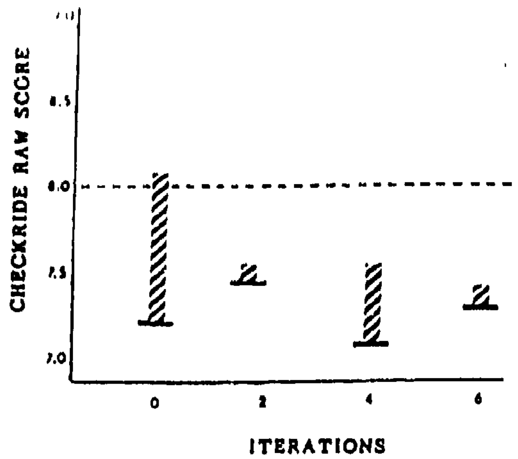


44. NOE FLIGHT

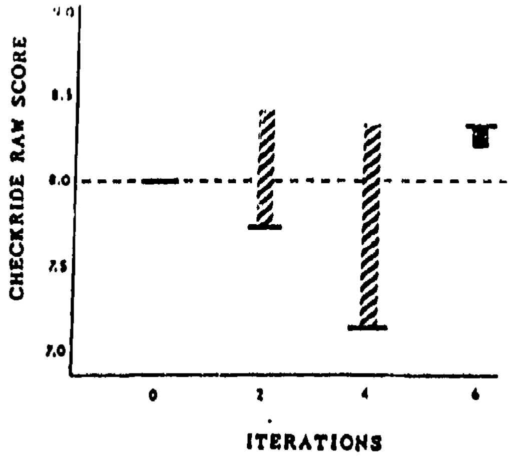


Note. = Decrease from Initial Checkride; = Increase from Initial Checkride.

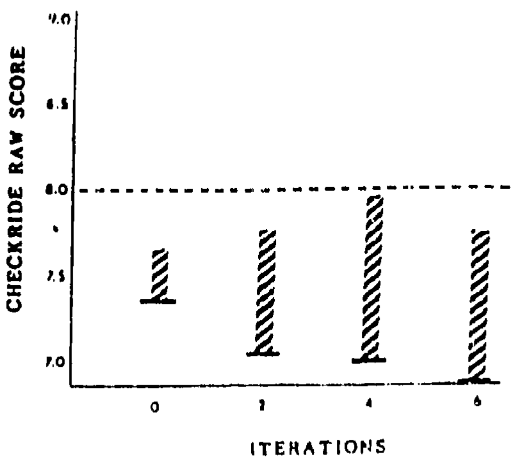
45. NOE DECELERATION



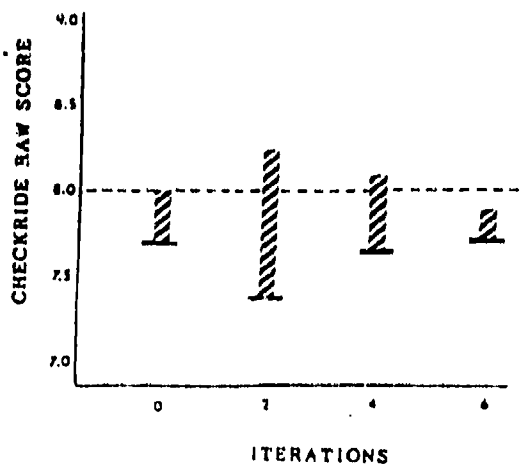
46. TERRAIN FLIGHT APPROACH



47. OUT-OF-GROUND EFFECT CHECK



48. TERRAIN FLIGHT TAKEOFF



Note. ▐ = Decrease from Initial Checkride, ▨ = Increase from Initial Checkride

APPENDIX H

MEANS, STANDARD DEVIATIONS, TASK-COMPOSITE CORRELATIONS, AND CORRELATION MATRIX FOR FINAL CHECKRIDE NORMALIZED SCORES

. SCORE CORRELATIONS AMONG FINAL CHECKRIDE NORMALIZED SCORES

	ATM TASK	M	SD	r[a]
1.	Plan VFR Flight	.02	.95	.29
2.	Weight and Balance Form	-.67	1.38	.23
3.	Use Performance Charts	.47	.96	.34
4.	Prepare Performance Planning Card (PPC)	.35	.85	.36
5.	Fuel Management	.30	1.02	.23
6.	Preflight Inspection	.57	.40	.46
7.	Before Takeoff Checks	.32	.73	.28
8.	Communications Procedures	.51	.51	.45
9.	After Landing Tasks	-.06	.70	.48
10.	Takeoff to Hover	.29	.57	.46
11.	Hover Check	.28	.62	.17
12.	Hover Turn	.36	.43	.55
13.	Hover Flight	.37	.42	.50
14.	Landing from Hover	.27	.53	.56
15.	Manual Throttle Operation	-.67	.87	.57
16.	Engine Failure at Hover	-.13	.81	.66
17.	Hovering Autorotation	-.05	.74	.64
18.	Slope Operations	.01	.61	.52
19.	Traffic Pattern	.25	.58	.53
20.	Climb/Descend	.29	.44	.50
21.	Turns	.33	.55	.65
22.	Straight-and-Level Flight	.25	.62	.63
23.	Normal Takeoff	.21	.62	.64
24.	Maximum Performance Takeoff	-.11	.78	.68
25.	Before Landing Checks	-.06	.85	.45
26.	Normal Approach	.07	.65	.68
27.	Steep Approach	-.15	.66	.53
28.	Shallow Approach Running Landing	.16	.76	.45
29.	Hydraulic Failure	-.41	.96	.64
30.	Antitorque Failure - Left	-.78	1.02	.66
31.	Antitorque Failure - Right	-.85	.97	.67
32.	Go-Around	.34	.47	.46
33.	Standard Autorotation	-.62	.98	.66
34.	Low-Level Autorotation	-.53	.93	.63
36.	Deceleration/Acceleration	.17	.73	.45
37.	Engine Failure at Altitude	.10	.76	.39
38.	High Reconnaissance	.43	.53	.58
39.	Confined Area Operations	.23	.59	.51
40.	Pinnacle/Ridgeline Operations	.04	.72	.57
41.	Terrain Flight Mission Planning	.51	.40	.59
42.	Terrain Flight Navigation	.37	.74	.52
43.	Low-Level Flight	.47	.51	.54
44.	NOE Flight	.41	.60	.68
45.	NOE Deceleration	-.04	.86	.52
46.	Terrain Flight Approach	.45	.50	.59
47.	Out-of-Ground-Effect Check	.10	.85	.46
48.	Terrain Flight Takeoff	.32	.65	.61

[a]Correlations greater than .23 are significant at the .05 level. Those greater than .30 are significant at the .01 level.

INTERCORRELATIONS AMONG FINAL CHECKRIDE NORMALIZED SCORES

TASK	1	2	3	4	5	6	7	8	9	10	11	12
1. Plan VFR Flight	--	.26	.02	.06	.15	.05	-.14	-.04	.03	.05	-.25	.29
2. Weight and Balance	.26	--	.07	.07	.21	.07	-.14	.18	-.07	.10	-.14	.04
3. Performance Charts	.02	.07	--	.86	.18	-.06	-.19	.15	.13	.20	-.10	.04
4. Prepare PPC	.06	.07	.86	--	.31	-.13	-.19	.07	.07	.14	-.12	.03
5. Fuel Management	.15	.21	.18	.31	--	-.08	-.02	-.01	.07	.01	-.00	.02
6. Preflight Inspect	.05	.07	-.06	-.13	-.08	--	.50	.52	.38	.28	.16	.20
7. Before T/O Checks	-.14	-.14	-.19	-.19	-.02	.50	--	.33	.51	.10	.56	.08
8. Radio Procedure	-.04	.18	.15	.07	-.01	.52	.33	--	.32	.27	.07	.17
9. After Land Tasks	.03	-.07	.13	.07	.07	.38	.51	.32	--	.25	.32	.21
10. T/O to Hover	.05	.10	.20	.14	.01	.28	.10	.27	.25	--	.27	.59
11. Hover Check	-.25	-.14	-.10	-.12	-.00	.16	.56	.07	.32	.27	--	.10
12. Hovering Turn	.29	.04	.04	.03	.02	.20	.08	.17	.21	.59	.10	--
13. Hovering Flight	.24	.06	.02	-.00	.03	.19	.10	.22	.11	.41	.04	.69
14. Landing From Hover	.29	.08	.18	.15	.09	.14	.14	.10	.20	.70	.24	.80
15. Manual Throttle Opn	.16	.07	.26	.29	.35	.04	.03	.20	.30	.15	.00	.25
16. Engine Fail Hover	.26	.07	.24	.23	.04	.17	.07	.26	.23	.32	.05	.43
17. Hovering Auto	.19	.21	.34	.36	.02	.17	.05	.30	.05	.31	.08	.34
18. Slope Operations	.23	.12	.02	.05	.06	.29	.01	.25	.09	.19	.00	.32
19. Traffic Pattern	.09	.11	-.01	-.01	-.03	.14	.15	.19	.19	.20	.10	.31
20. Climb/Descend	.24	.13	-.04	-.02	.04	.29	.02	.07	.06	.26	-.12	.41
21. Turns	.15	.12	.14	.07	.01	.52	.13	.22	.29	.38	.03	.42
22. Straight/Level Flt	.05	.11	.04	-.04	-.02	.40	.27	.31	.40	.36	.19	.38
23. Normal Takeoff	.12	.18	.30	.30	.09	.36	.07	.28	.28	.43	.08	.42
24. Max Performance T/O	.17	.18	.31	.28	.19	.25	.08	.24	.41	.33	.09	.35
25. Before Land Checks	-.03	.06	.02	-.06	.09	.41	.36	.31	.50	.22	.39	.15
26. Normal Approach	.24	.06	.41	.38	.09	.04	.04	.24	.38	.41	-.05	.50
27. Steep Approach	.01	-.08	.31	.27	.07	.13	.03	.15	.40	.23	-.01	.26
28. Shallow App Run Land	.05	.05	.03	.05	.16	.23	.17	.13	.20	.04	.13	.04
29. Hydraulic Failure	.23	.14	.06	.13	.20	.27	.20	.13	.21	.15	.08	.32
30. Antitorque Fail-L	.15	.15	.07	.08	.11	.45	.33	.29	.39	.26	.11	.23
31. Antitorque Fail-R	.12	.12	.27	.29	.13	.29	.28	.33	.31	.20	.15	.16
32. Go-Around	.21	.00	.06	.15	.06	.24	.17	-.01	.19	.19	.03	.41
33. Standard Auto	.29	.12	.32	.39	.13	.26	.07	.28	.25	.22	-.01	.28
34. Low Level Auto	.13	.13	.21	.22	.02	.21	.05	.32	.28	.37	.08	.34
36. Decel/Accel	.03	.07	.03	.06	.12	.12	.03	.25	.12	.01	.05	.15
37. Eng Fail at Alt	.23	.05	-.01	-.04	-.10	.17	.07	.14	.01	.07	-.07	.23
38. High Reconnaissance	.06	-.04	.21	.27	.14	.08	.05	.16	.22	.21	.14	.18
39. Confined Area Opns	.05	.03	.14	.18	.05	.10	.19	.21	.22	.15	.31	.17
40. Pin/Ridgeline Opns	.72	.15	.13	.23	.05	.12	.08	.10	.35	.15	.06	.20
41. Ter Flight Plan	.16	-.01	.07	.11	.04	.48	.30	.36	.27	.21	.09	.40
42. Ter Flight Nav	.14	.12	.31	.26	.10	.31	.02	.25	.11	.11	-.06	25
43. Low Level Flight	.55	-.01	-.03	.06	.04	.53	.37	.38	.34	.20	.15	26
44. NOE Flight	.06	.09	.19	.32	.09	.33	.16	.29	.24	.15	.01	.30
45. NOE Deceleration	.09	-.02	.06	.05	-.01	.26	.13	.17	.19	.39	.18	.51
46. Ter Flight Approach	.11	.04	.18	.25	.05	.24	.07	.31	.22	.24	.06	.37
47. OGE Check	-.02	.03	-.00	.04	.03	.30	.25	.36	.19	.22	06	.36
48. Ter Flight Takeoff	.07	.07	.11	.10	.08	.57	.26	.32	.28	.22	04	.29

Note. N = 78. Correlations greater than .22 are significant at the .05 level. Those greater than .30 are significant at the .01 level.

INTERCORRELATIONS AMONG FINAL CHECKRIDE NORMALIZED SCORES

	TASK	13	14	15	16	17	18	19	20	21	22	23	24
1.	Plan VFR Flight	.24	.29	.16	.26	.19	.23	.09	.24	.15	.05	.12	.17
2.	Weight and Balance	.06	.08	.07	.07	.21	.11	.11	.13	.12	.11	.18	.18
3.	Performance Charts	.02	.18	.26	.24	.34	.02	-.01	-.04	.14	.04	.30	.31
4.	Prepare PPC	-.00	.15	.29	.23	.36	.05	-.01	-.02	.07	-.04	.30	.28
5.	Fuel Management	.03	.09	.35	.04	.02	.06	-.03	.04	.01	-.02	.09	.19
6.	Preflight Inspect	.19	.14	.04	.17	.17	.29	.14	.29	.52	.40	.36	.25
7.	Before T/O Checks	.10	.14	.03	.07	.05	.01	.15	.02	.13	.27	.07	.08
8.	Radio Procedure	.22	.10	.20	.26	.30	.25	.19	.07	.22	.31	.28	.24
9.	After Land Tasks	.11	.20	.30	.23	.06	.09	.19	.06	.29	.40	.28	.41
10.	T/O to Hover	.41	.70	.15	.32	.31	.19	.20	.26	.38	.36	.43	.33
11.	Hover Check	.04	.24	.00	.05	.08	.00	.10	-.12	.03	.19	.08	.09
12.	H vering Turn	.69	.80	.25	.43	.34	.32	.31	.41	.42	.38	.42	.35
13.	Hovering Flight	--	.65	.26	.34	.25	.30	.33	.34	.32	.33	.53	.31
14.	Landing From Hover	.65	--	.23	.48	.38	.32	.32	.39	.40	.37	.45	.38
15.	Manual Throttle Opn	.26	.23	--	.38	.36	.31	.22	.12	.19	.32	.35	.38
16.	Engine Fail Hover	.34	.48	.39	--	.70	.43	.30	.35	.37	.38	.33	.42
17.	Hovering Auto	.25	.38	.36	.70	--	.41	.35	.35	.40	.39	.34	.39
18.	Slope Operations	.30	.32	.31	.43	.41	--	.27	.41	.39	.33	.39	.32
19.	Traffic Pattern	.33	.32	.22	.40	.35	.27	--	.62	.60	.74	.36	.28
20.	Climb/Descend	.34	.39	.12	.35	.35	.41	.62	--	.78	.56	.33	.37
21.	Turns	.32	.40	.19	.37	.40	.39	.60	.78	--	.74	.49	.52
22.	Straight/Level Flt	.33	.37	.32	.38	.39	.33	.74	.56	.74	--	.44	.38
23.	Normal Takeoff	.53	.45	.35	.33	.34	.39	.36	.33	.49	.44	--	.39
24.	Max Performance T/O	.31	.38	.38	.42	.39	.32	.28	.37	.52	.38	.39	--
25.	Before Land Checks	.15	.17	.33	.25	.16	.19	.19	.04	.25	.46	.21	.37
26.	Normal Approach	.51	.54	.41	.55	.46	.38	.40	.40	.37	.35	.52	.48
27.	Steep Approach	.23	.30	.27	.33	.27	.19	.33	.28	.37	.35	.32	.42
28.	Shallow App Run Land	.18	.13	.33	.18	.26	.18	.12	.16	.31	.26	.33	.31
29.	Hydraulic Failure	.24	.27	.45	.38	.43	.35	.24	.40	.42	.25	.30	.34
30.	Antitorque Fail-L	.11	.24	.33	.45	.36	.38	.24	.25	.41	.40	.35	.38
31.	Antitorque Fail-R	.21	.27	.37	.53	.47	.36	.33	.20	.32	.36	.27	.46
32.	Go-Around	.35	.31	.19	.35	.27	.19	.28	.33	.29	.25	.26	.24
33.	Standard Auto	.11	.29	.29	.53	.44	.34	.29	.25	.38	.38	.29	.41
34.	Low Level Auto	.18	.30	.33	.50	.39	.35	.38	.21	.34	.36	.48	.34
36.	Decel/Accel	.33	.06	.32	.18	.16	.34	.40	.31	.20	.27	.23	.31
37.	Eng Fail at Alt	.32	.21	.29	.31	.27	.21	.16	.15	.19	.15	.23	.23
38.	High Reconnaissance	.24	.19	.30	.30	.32	.14	.39	.25	.33	.31	.30	.40
39.	Confined Area Opns"	.24	.23	.36	.25	.33	.24	.30	.15	.23	.40	.29	.19
40.	Pin/Ridgeline Opns	.19	.23	.45	.28	.31	.20	.30	.24	.29	.37	.32	.40
41.	Ter Flight Plan	.30	.23	.24	.32	.29	.32	.23	.32	42	.30	.42	.27
42.	Ter Flight Nav	.14	.18	.29	.25	.35	.25	.16	.22	.29	.25	.32	.36
43.	Low Level Flight	.22	.13	.23	.21	.21	.14	.34	.22	.36	.40	.35	.31
44.	NOE Flight	.22	.18	.35	.33	.39	.37	.32	.24	.38	.34	.40	.40
45.	NOE Deceleration	.35	.41	.13	.41	.33	.41	.28	.37	.40	.26	.22	.29
46.	Ter Flight Approach	.32	.24	.20	.29	.34	.11	.40	.32	.39	.39	.29	.41
47.	OGE Check	.42	.25	.17	.17	.17	.10	36	.27	.27	.29	.37	.18
48.	Ter Flight Takeoff	.37	.15	.28	.27	.27	.16	.27	.24	.44	.44	.46	.46

Note. N = 78. Correlations greater than .23 are significant at the .05 level. Those greater than .30 are significant at the .01 level.

INTERCORRELATIONS AMONG FINAL CHECKRIDE NORMALIZED SCORES

TASK	25	26	27	28	29	30	31	32	33	34	36	37
1. Plan VFR Flight	-.03	.24	.01	.05	.23	.15	.12	.21	.29	.13	.03	.23
2. Weight and Balance	.06	.06	-.08	.05	.14	.15	.12	.00	.12	.13	.07	.05
3. Performance Charts	.02	.41	.31	.03	.06	.07	.27	.06	.32	.21	.03	-.01
4. Prepare PPC	-.06	.38	.27	.05	.13	.08	.29	.15	.39	.22	.06	-.04
5. Fuel Management	.09	.09	.07	.16	.20	.11	.13	.06	.13	.02	.12	-.10
6. Preflight Inspect	.41	.04	.13	.23	.27	.45	.29	.24	.26	.21	.12	.17
7. Before T/O Checks	.36	.04	.03	.17	.20	.33	.28	.17	.07	.05	.03	.07
8. Radio Procedure	.31	.24	.15	.13	.13	.29	.33	.01	.28	.32	.25	.14
9. After Land Tasks	.50	.38	.40	.20	.21	.40	.31	.19	.25	.28	.12	.01
10. T/O to Hover	.22	.41	.23	.04	.15	.26	.20	.19	.22	.32	.01	.07
11. Hover Check	.39	-.05	-.01	.13	.08	.11	.15	.03	-.01	.08	.05	-.07
12. Hovering Turn	.15	.50	.26	.04	.32	.23	.16	.41	.28	.34	.15	.23
13. Hovering Flight	.15	.51	.23	.18	.24	.11	.21	.35	.11	.18	.33	.32
14. Landing From Hover	.17	.54	.30	.13	.27	.24	.27	.31	.29	.30	.06	.21
15. Manual Throttle Opn	.33	.41	.27	.33	.45	.33	.37	.19	.29	.33	.32	.29
16. Engine Fail Hover	.25	.55	.33	.18	.38	.45	.53	.35	.53	.50	.18	.31
17. Hovering Auto	.16	.46	.27	.26	.43	.36	.47	.27	.44	.39	.16	.27
18. Slope Operations	.19	.38	.19	.18	.35	.38	.36	.19	.34	.35	.34	.21
19. Traffic Pattern	.19	.40	.33	.12	.24	.24	.33	.28	.29	.38	.40	.16
20. Climb/Descend	.04	.40	.28	.16	.40	.25	.21	.33	.25	.21	.31	.15
21. Turns	.25	.37	.37	.31	.42	.41	.32	.29	.38	.34	.20	.19
22. Straight/Level Flt	.46	.35	.35	.26	.25	.40	.36	.25	.38	.36	.27	.15
23. Normal Takeoff	.21	.52	.32	.33	.30	.35	.27	.26	.29	.48	.23	.23
24. Max Performance T/O	.37	.48	.42	.31	.34	.38	.46	.24	.41	.34	.31	.23
25. Before Land Checks	--	.10	.12	.14	.20	.25	.38	.32	.18	.16	.16	.09
26. Normal Approach	.10	--	.64	.20	.37	.36	.46	.21	.46	.47	.37	.19
27. Steep Approach	.12	.64	--	.26	.23	.34	.29	.14	.41	.46	.34	.02
28. Shallow App Run Land	.14	.20	.26	--	.49	.50	.42	.11	.33	.32	.14	.24
29. Hydraulic Failure	.20	.37	.23	.49	--	.55	.45	.31	.40	.39	.22	.45
30. Antitorque Fail-L	.25	.36	.34	.50	.55	--	.69	.21	.59	.54	.18	.45
31. Antitorque Fail-R	.38	.46	.29	.42	.45	.69	--	.28	.55	.52	.26	.28
32. Go-Around	.32	.21	.14	.11	.31	.21	.28	--	.14	.16	.10	.24
33. Standard Auto	.18	.46	.41	.33	.40	.59	.55	.14	--	.68	.18	.10
34. Low Level Auto	.16	.47	.46	.32	.39	.54	.52	.16	.68	--	.14	.20
36. Decel/Accel	.16	.37	.34	.14	.22	.18	.26	.10	.18	.14	--	.21
37. Eng Fail at Alt	.09	.19	.02	.24	.45	.13	.28	.24	.10	.20	.21	--
38. High Reconnaissance	.12	.38	.37	.33	.29	.24	.32	.25	.36	.30	.45	.26
39. Confined Area Opns	.23	.25	.29	.36	.29	.28	.26	.16	.28	.33	.37	.17
40. Pin/Ridgeline Opns	.17	.34	.43	.40	.35	.50	.42	.25	.39	.43	.34	.07
41. Ter Flight Plan	.25	.28	.18	.10	.38	.30	.24	.42	.23	.23	.41	.39
42. Ter Flight Nav	.20	.29	.27	.12	.33	.23	.24	.34	.31	.23	.27	.25
43. Low Level Flight	.41	.11	.08	.11	.26	.31	.26	.52	.20	.24	.21	.29
44. NOE Flight	.26	.35	.35	.27	.37	.39	.33	.37	.53	.45	.41	.26
45. OGE Deceleration	.10	.36	.23	.06	.47	.31	.20	.33	.32	.34	.31	.31
46. Ter Flight Approach	.23	.31	.30	.17	.26	.24	.31	.31	.41	.35	.27	.29
47. OGE Check	.27	.27	.16	-.03	.23	.12	.21	.29	.09	.14	.30	.28
48. Ter Flight Takeoff	.29	.22	.23	.25	.33	.38	.26	.29	.27	.19	.35	.27

Note. N = 78. Correlations greater than .23 are significant at the .05 level. Those greater than .30 are significant at the .01 level.

INTERCORRELATIONS AMONG FINAL CHECKRIDE NORMALIZED SCORES

TASK	38	39	40	41	42	43	44	45	46	47	48
1. Plan VFR Flight	.56	-.05	.07	.16	.14	.05	.06	.09	.11	-.02	.07
2. Weight and Balance	-.04	.03	.15	-.01	.12	-.01	.09	-.02	-.04	.02	.07
3. Performance Charts	.21	.14	.13	.07	.31	-.03	.19	.06	.18	-.00	.11
4. Prepare PPC	.27	.18	.23	.11	.26	.06	.32	.05	.25	.04	.10
5. Fuel Management	.17	.05	.05	.04	.10	.04	.09	-.01	.05	.03	.08
6. Preflight Inspect	.08	.10	.12	.48	.31	.53	.33	.26	.24	.30	.57
7. Before T/O Checks	.05	.19	.08	.30	.02	.37	.16	.13	.07	.25	.26
8. Radio Procedure	.18	.21	.10	.36	.25	.38	.29	.17	.31	.36	.32
9. After Land Tasks	.22	.22	.35	.27	.11	.34	.24	.19	.22	.19	.28
10. T/O to Hover	.21	.15	.15	.21	.11	.20	.15	.39	.24	.21	.22
11. Hover Check	.14	.31	.06	.09	-.06	.15	.00	.18	.06	.06	.04
12. Hovering Turn	.18	.17	.20	.39	.25	.26	.30	.51	.37	.36	.29
13. Hovering Flight	.24	.24	.19	.30	.14	.22	.22	.35	.32	.42	.37
14. Landing From Hover	.19	.23	.23	.23	.18	.13	.18	.41	.24	.25	.15
15. Manual Throttle Opn	.30	.36	.45	.24	.29	.23	.35	.13	.20	.17	.26
16. Engine Fail Hover	.30	.25	.28	.32	.25	.21	.33	.41	.29	.17	.27
17. Hovering Auto	.32	.33	.31	.29	.35	.21	.39	.33	.34	.17	.27
18. Slope Operations	.14	.24	.20	.32	.25	.14	.37	.41	.11	.10	.16
19. Traffic Pattern	.39	.30	.30	.23	.16	.34	.32	.28	.40	.36	.27
20. Climb/Descend	.25	.15	.24	.32	.22	.22	.24	.37	.32	.27	.24
21. Turns	.33	.23	.29	.42	.29	.36	.38	.40	.39	.27	.44
22. Straight/Level Flt	.31	.40	.37	.30	.25	.40	.34	.26	.39	.29	.44
23. Normal Takeoff	.30	.29	.32	.42	.32	.35	.40	.22	.29	.37	.46
24. Max Performance T/O	.40	.19	.40	.27	.36	.31	.40	.29	.41	.18	.46
25. Before Land Checks	.12	.23	.18	.25	.20	.41	.26	.10	.23	.27	.29
26. Normal Approach	.38	.25	.34	.28	.29	.11	.35	.36	.31	.27	.22
27. Steep Approach	.37	.29	.43	.18	.27	.08	.35	.23	.30	.16	.23
28. Shallow App Run Land	[illegible]	.36	.40	.10	.12	.11	.22	.06	.17	-.03	.25
29. Hydraulic Failure	.29	.29	.35	.38	.33	.26	.39	.47	.26	.23	.33
30. Antitorque Fail-L	.24	.28	.50	.30	.23	.31	.39	.31	.24	.12	.38
31. Antitorque Fail-R	.32	.26	.42	.24	.24	.26	.33	.20	.31	.21	.26
32. Go-Around	.25	.16	.25	.42	.34	.52	.37	.22	.31	.29	.29
33. Standard Autp	.36	.28	.40	.23	.31	.20	.53	.32	.41	.09	.27
34. Low Level Auto	.30	.33	.43	.23	.23	.24	.45	.34	.35	.14	.19
36. Decel/Accel	.45	.37	.34	.41	.27	.21	.41	.31	.27	.30	.36
37. Eng Fail at Alt	.26	.17	.07	.39	.28	.29	.26	.31	.29	.28	.37
38. High Reconnaissance	--	.63	.41	.39	.31	.45	.57	.29	.66	.31	.47
39. Confined Area Opns	.63	--	.61	.26	.19	.25	.42	.25	.40	.21	.23
40. Pin/Ridgeline Opns	.41	.61	--	.17	.15	.22	.41	.22	.36	.15	.25
41. Ter Flight Plan	.39	.26	.17	--	.58	.69	.56	.41	.40	.49	.57
42. Ter Flight Nav	.31	.19	.15	.58	--	.50	.46	.18	.33	.36	.48
43. Low Level Flight	.45	.25	.22	.69	.50	--	[illegible]	.26	.52	.47	.65
44. NOE Flight	.57	.42	.41	.56	.46	.60	--	.48	.68	.39	.59
45. NOE Deceleration	.29	.25	.22	.41	.18	.26	.48	--	.36	.24	.37
46. Ter Flight Approach	.66	.40	.36	.40	.32	.52	.68	.36	--	.47	.59
47. OGE Check	.31	.21	.15	.49	.36	.47	.39	.24	.47	--	.58
48. Ter Flight Takeoff	.47	.23	.25	.57	.48	.65	.59	.37	.59	.58	--

Note. N = 78. Correlations greater than .23 are significant at the .05 level. Those greater than .30 are significant at the .01 level.

APPENDIX I

MEANS, STANDARD DEVIATIONS, AND INTERCORRELATIONS FOR CONFIDENCE RATINGS AND FINAL CHECKRIDE NORMALIZED SCORES

1. PLAN VFR Flight

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	78.32	14.62	--					
2. Checkride Score	-.41	.96	.04	--				
3. Post-Confidence Rating	81.75	13.53	.60**	.11	--			
Final Checkride								
4. Pre-Confidence Rating	75.41	16.50	.09	.21*	.30**	--		
5. Checkride Score	.02	.95	.01	.24*	-.04	.02	--	
6. Post-Confidence Rating	81.38	14.76	.32**	.02	.51**	.66**	.02	--

2. PREPARE WEIGHT AND BALANCE FORM

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	53.03	26.66	--					
2. Checkride Score	-1.51	.89	.37**	--				
3. Post-Confidence Rating	59.82	27.50	.74**	.47**	--			
Final Checkride								
4. Pre-Confidence Rating	59.50	26.56	.42**	.37**	.37**	--		
5. Checkride Score	-.67	1.38	-.01	.15	.05	.35**	--	
6. Post-Confidence Rating	69.77	22.80	.42**	.27*	.36**	.68**	.30**	--

3. USE PERFORMANCE CHART

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	66.05	20.96	--					
2. Checkride Score	-.11	1.04	.19	--				
3. Post-Confidence Rating	65.77	23.29	.76**	.34**	--			
Final Checkride								
4. Pre-Confidence Rating	66.05	20.96	.38**	.03	.39**	--		
5. Checkride Score	-.11	1.04	.08	.15	.23**	.13	--	
6. Post-Confidence Rating	65.77	23.19	.30**	.10	.42**	.76**	.12	--

4. PREPARE PERFORMANCE PLANNING CARD

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	64.03	22.71	--					
2. Checkride Score	-.31	1.03	.22	--				
3. Post-Confidence Rating	66.34	22.57	.78**	.36**	--			
Final Checkride								
4. Pre-Confidence Rating	65.73	23.16	.37**	.03	.39**	--		
5. Checkride Score	.35	.83	.07	.09	.24	.19	--	
6. Post-Confidence Rating	72.50	21.31	.33**	.09	.43**	.77**	.28*	--

Note. *p <.05; **p< .01. Number of subjects = 75-78 except where noted otherwise.

5. FUEL MANAGEMENT PROCEDURES

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	81.55	14.99	--					
2. Checkride Score	.04	1.08	-.09	--				
3. Post-Confidence Rating	80.50	17.96	.55**	.19	--			
Final Checkride								
4. Pre-Confidence Rating	79.56	15.43	.38**	.10	.50**	--		
5. Checkride Score	.30	1.02	.15	.11	.18	.17	--	
6. Post-Confidence Rating	79.65	15.19	.27*	.23	.33**	.62**	.26*	--

6. PREFLIGHT INSPECTION

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	78.56	17.56	--					
2. Checkride Score	.76	.61	.13	--				
3. Post-Confidence Rating	82.72	15.25	.80**	.17	--			
Final Checkride								
4. Pre-Confidence Rating	78.12	16.40	.34**	.14	.43**	--		
5. Checkride Score	.57	.40	-.05	-.18	-.03	-.10	--	
6. Post-Confidence Rating	83.58	13.90	.34**	.03	.50**	.65**	-.08	--

7. BEFORE TAKEOFF CHECKS

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	82.07	14.77	--					
2. Checkride Score	.80	.50	.11	--				
3. Post-Confidence Rating	83.17	13.90	.62**	.11	--			
Final Checkride								
4. Pre-Confidence Rating	80.51	14.03	.38**	.04	.41**	--		
5. Checkride Score	.32	.73	-.00	-.04	.02	.04	--	
6. Post-Confidence Rating	82.96	14.95	.43**	-.03	.62**	.64**	.11	--

8. RADIO COMMUNICATIONS PROCEDURES

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	80.41	15.85	--					
2. Checkride Score	.54	.72	.08	--				
3. Post-Confidence Rating	82.17	15.01	.57**	.00	--			
Final Checkride								
4. Pre-Confidence Rating	77.49	16.74	.31**	.11	.41**	--		
5. Checkride Score	.51	.51	-.02	.02	.03	.10	--	
6. Post-Confidence Rating	82.77	13.03	.32**	.11	.54**	.67**	.09	--

Note. $*p < .05$; $**p < .01$. Number of subjects = 75–78 except where noted otherwise.

9. AFTER LANDING TASKS

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	78.[illegible]	16.71	--					
2. Checkride Score	.07	1.06	-.11	--				
3. Post-Confidence Rating	81.15	14.29	.60**	-.05	--			
Final Checkride								
4. Pre-Confidence Rating	78.42	15.64	.44**	-.00	.58**	--		
5. Checkride Score	-.06	.70	.05	.36**	.10	-.00	--	
6. Post-Confidence Rating	82.41	13.92	.49**	.00	.58**	.76**	.14	--

10. TAKEOFF TO A HOVER

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	84.51	14.17	--					
2. Checkride Score	.26	.81	-.14	--				
3. Post-Confidence Rating	.84	14.03	.65**	-.00	--			
Final Checkride								
4. Pre-Confidence Rating	81.52	14.02	.37**	-.06	.50**	--		
5. Checkride Score	.28	.56	-.04	.09	.06	.25*	--	
6. Post-Confidence Rating	83.96	12.61	.43**	.09	.61**	.74**	.09	--

11. HOVER CHECKS

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	81.56	16.11	--					
2. Checkride Score	.19	.85	-.08	--				
3. Post-Confidence Rating	81.91	15.94	.63**	.08	--			
Final Checkride								
4. Pre-Confidence Rating	80.97	14.00	.36**	.01	.49**	--		
5. Checkride Score	.28	.62	-.10	.14	-.10	.09	--	
6. Post-Confidence Rating	82.94	13.69	.36**	.06	.65**	.68**	.03	--

12. HOVERING TURN

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	83.76	14.04	--					
2. Checkride Score	.47	.75	-.05	--				
3. Post-Confidence Rating	81.18	14.04	.68**	-.02	--			
Final Checkride								
4. Pre-Confidence Rating	81.27	13.36	.36**	-.09	.48**	--		
5. Checkride Score	.36	.43	-.05	-.18	-.04	.15	--	
6. Post-Confidence Rating	83.62	12.49	.50*	-.02	.70**	.77**	.09	--

Note. *p < .05; **p < .01. Number of subjects = 75-78 except where noted otherwise.

13. HOVERING FLIGHT

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	83.82	13.94	--					
2. Checkride Score	50	.74	-.10	--				
3. Post-Confidence Rating	83.36	13.80	.69**	.14	--			
Final Checkride								
4. Pre-Confidence Rating	80.76	13.38	.42**	-.06	.48**	--		
5. Checkride Score	.37	.42	.12	-.22	.11	.09	--	
6. Post-Confidence Rating	84.00	12.52	.49**	-.06	.70**	.74**	.05	--

14. LANDING FROM A HOVER

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	81.87	15.79	--					
2. Checkride Score	.18	.76	-.00	--				
3. Post-Confidence Rating	81.42	15.56	.75**	.06	--			
Final Checkride								
4. Pre-Confidence Rating	79.32	14.66	.37**	-.00	.50**	--		
5. Checkride Score	.27	.53	.04	-.06	.03	.12	--	
6. Post-Confidence Rating	83.10	13.06	.41**	.00	.59**	.66**	.07	--

15. MANUAL THROTTLE OPERATION

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	58.87	20.04	--					
2. Checkride Score	-.57	.94	.31**	--				
3. Post-Confidence Rating	66.97	23.36	.55**	.35**	--			
Final Checkride								
4. Pre-Confidence Rating	59.82	20.20	.44**	.40**	.61**	--		
5. Checkride Score	-.67	.87	.26*	.21	.05	.23	--	
6. Post-Confidence Rating	64.73	21.12	.36*	.21	.45**	.65**	.43**	--

16. ENGINE FAILURE AT A HOVER

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	76.77	17.82	--					
2. Checkride Score	.21	.87	.05	--				
3. Post-Confidence Rating	80.05	16.32	.68**	.10	--			
Final Checkride								
4. Pre-Confidence Rating	74.19	15.90	.44**	.17	.56**	--		
5. Checkride Score	-.31	.81	.20	.08	.22	.33**	--	
6. Post-Confidence Rating	81.45	14.96	.42**	.06	.66**	.75**	26*	--

Note. *p < .05; **p < .01. Number of subjects = 75-78 except where noted otherwise.

17. HOVERING AUTOROTATION

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	76.82	16.75	--					
2. Checkride Score	-.05	.88	.11	--				
3. Post-Confidence Rating	79.95	15.75	.69**	.18	--			
Final Checkride								
4. Pre-Confidence Rating	73.84	16.89	.42**	.26*	.49**	--		
5. Checkride Score	-.05	.74	.13	.14	.22	.28*	--	
6. Post-Confidence Rating	81.28	15.13	.41**	.13	.60**	.78**	.27*	--

18. SLOPE OPERATIONS

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	69.26	18.01	--					
2. Checkride Score	-.11	.96	.06	--				
3. Post-Confidence Rating	75.96	17.84	.63**	.18	--			
Final Checkride								
4. Pre-Confidence Rating	70.15	18.36	.58**	.17	.53**	--		
5. Checkride Score	.01	.61	.24*	-.04	.15	.21	--	
6. Post-Confidence Rating	77.31	15.11	.41**	.05	.49**	.72**	.18	--

19. TRAFFIC PATTERN

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	80.04	16.86	--					
2. Checkride Score	-.03	.86	-.10	--				
3. Post-Confidence Rating	78.03	18.25	.63**	.02	--			
Final Checkride								
4. Pre-Confidence Rating	77.97	16.00	.52**	.05	.60**	--		
5. Checkride Score	.25	.58	-.05	-.03	.02	-.03	--	
6. Post-Confidence Rating	80.47	15.74	.42**	.03	.69**	.65**	.07	--

20. CLIMB/DESCEND

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	83.38	13.88	--					
2. Checkride Score	.08	.77	-.11	--				
3. Post-Confidence Rating	83.21	13.79	.67**	-.00	--			
Final Checkride								
4. Pre-Confidence Rating	80.72	12.89	.35**	.04	.46**	--		
5. Checkride Score	.29	.44	-.04	.02	-.02	-.02	--	
6. Post-Confidence Rating	82.11	12.84	.36**	-.02	.66*	.69**	-.12	--

<u>Note</u>. *$p < .05$; **$p < .01$. Number of subjects = 75-78 except where noted otherwise.

21. TURNS

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	84.64	13.96	--					
2. Checkride Score	.07	.79	-.04	--				
3. Post-Confidence Rating	82.59	14.82	.67**	.04	--			
Final Checkride								
4. Pre-Confidence Rating	81.18	15.85	.44**	.05	.50**	--		
5. Checkride Score	.33	.54	-.10	.28*	.01	-.07	--	
6. Post-Confidence Rating	82.91	13.23	.55**	.03	.68**	.79**	-.12	--

22. STRAIGHT AND LEVEL FLIGHT

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	85.38	14.01	--					
2. Checkride Score	.34	.78	.02	--				
3. Post-Confidence Rating	83.44	14.81	.70**	-.05	--			
Final Checkride								
4. Pre-Confidence Rating	83.21	13.11	.47**	.16	.57**	--		
5. Checkride Score	.24	.61	.09	.05	.07	.06	--	
6. Post-Confidence Rating	83.49	13.01	.52**	.12	.70**	.74**	.04	--

23. NORMAL TAKEOFF

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	83.86	13.38	--					
2. Checkride Score	.09	.84	-.14	--				
3. Post-Confidence Rating	83.41	13.79	.67**	-.11	--			
Final Checkride								
4. Pre-Confidence Rating	80.10	13.46	.37**	-.01	.49**	--		
5. Checkride Score	.21	.62	.13	-.05	.20	.22	--	
6. Post-Confidence Rating	82.92	12.71	.39**	-.08	.70**	.71**	.24*	--

24. MAXIMUM PERFORMANCE TAKEOFF

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	78.99	15.36	--					
2. Checkride Score	-.30	.87	.12	--				
3. Post-Confidence Rating	80.63	15.30	.69**	.07	--			
Final Checkride								
4. Pre-Confidence Rating	77.22	15.54	.35**	.06	.48**	--		
5. Checkride Score	-.11	.78	.07	-.00	.23	.18	--	
6. Post-Confidence Rating	79.97	15.05	.36**	.23	.59**	.57**	.15	--

Note. $*p < .05$; $**p < .01$. Number of subjects = 75-78 except where noted otherwise.

25. BEFORE LANDING CHECKS

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	83.84	15.03	--					
2. Checkride Score	.02	1.05	-.13	--				
3. Post-Confidence Rating	82.69	14.24	.71**	.08	--			
Final Checkride								
4. Pre-Confidence Rating	82.06	13.40	.41**	.01	.53**	--		
5. Checkride Score	-.06	.85	.11	.06	.17	.27*	--	
6. Post-Confidence Rating	82.93	15.28	.50**	.03	.65**	.72**	.21	--

26. NORMAL APPROACH

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	79.18	16.56	--					
2. Checkride Score	-.09	.89	-.13	--				
3. Post-Confidence Rating	78.95	17.53	.70**	.02	--			
Final Checkride								
4. Pre-Confidence Rating	78.52	15.01	.44**	.06	.53**	--		
5. Checkride Score	.07	.65	.11	.11	.17	.23	--	
6. Post-Confidence Rating	81.03	14.43	.43**	.11	.65**	.69**	.21	--

27. STEEP APPROACH

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	78.99	15.89	--					
2. Checkride Score	-.28	.81	.06	--				
3. Post-Confidence Rating	77.75	18.20	.71**	.02	--			
Final Checkride								
4. Pre-Confidence Rating	77.71	14.86	.40**	-.03	.47**	--		
5. Checkride Score	-.15	.66	.03	.00	.09	.06	--	
6. Post-Confidence Rating	79.10	14.68	.37**	-.01	.51**	.60**	.17	--

28. SHALLOW APPROACH TO A RUNNING LANDING

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	78.77	16.10	--					
2. Checkride Score	-.07	.94	.14	--				
3. Post-Confidence Rating	79.67	17.47	.65**	.15	--			
Final Checkride								
4. Pre-Confidence Rating	77.04	15.75	.42**	.02	.55**	--		
5. Checkride Score	.16	.76	.15	.10	.05	.18	--	
6. Post-Confidence Rating	80.67	14.80	.37**	.07	.66**	.72**	.16	--

Note. $*p < .05$; $**p < .01$. Number of subjects = 75-78 except where noted otherwise.

29. HYDRAULICS FAILURE

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	74.50	16.70	--					
2. Checkride Score	-.35	.94	.07	--				
3. Post-Confidence Rating	77.97	16.43	.63**	.29*	--			
Final Checkride								
4. Pre-Confidence Rating	72.85	16.64	.43**	.01	.50**	--		
5. Checkride Score	-.41	.96	.00	.16	.05	.09	--	
6. Post-Confidence Rating	79.10	14.60	.31**	-.06	.60**	.65**	.11	--

30. ANTITORQUE FAILURE--LEFT PEDAL

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	61.26	20.08	--					
2. Checkride Score	-1.15	1.07	.12	--				
3. Post-Confidence Rating	64.73	22.62	.65**	.26*	--			
Final Checkride								
4. Pre-Confidence Rating	59.41	20.56	.39**	.12	.58**	--		
5. Checkride Score	-.78	1.02	.30**	.39**	.23	.23	--	
6. Post-Confidence Rating	68.90	19.19	.39**	.02	.58**	.67**	.33**	--

31. ANTITORQUE FAILURE--RIGHT PEDAL

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	61.26	20.08	--					
2. Checkride Score	-1.12	1.05	.23	--				
3. Post-Confidence Rating	64.73	22.62	.65**	.47**	--			
Final Checkride								
4. Pre-Confidence Rating	59.41	20.56	.39**	.20	.57**	--		
5. Checkride Score	-.85	.97	.20	.23	.25*	.28*	--	
6. Post-Confidence Rating	68.90	19.19	.39**	.19	.58**	.67**	.44**	--

32. GO-AROUND

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	81.31	16.26	--					
2. Checkride Score	.20	.78	-.05	--				
3. Post-Confidence Rating	80.08	16.79	.54**	-.07	--			
Final Checkride								
4. Pre-Confidence Rating	79.68	14.76	.44**	.03	.46**	--		
5. Checkride Score	.34	.47	-.03	.06	.04	.07	--	
6. Post-Confidence Rating	81.94	15.83	.43**	.11	.50**	.78**	.25*	

Note. *$p < .05$; **$p < .01$. Number of subjects = 75-78 except where noted otherwise.

33. STANDARD AUTOROTATION

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	74.20	18.85	--					
2. Checkride Score	-.84	.97	.09	--				
3. Post-Confidence Rating	74.11	20.92	.61**	.39**	--			
Final Checkride								
4. Pre-Confidence Rating	71.14	19.08	.52**	.19	.53**	--		
5. Checkride Score	-.62	.98	.30*	.14	.23	.20	--	
6. Post-Confidence Rating	77.45	16.28	.45**	.27	.57**	.73**	.33*	--

34. LOW LEVEL AUTOROTATION

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	73.15	18.86	--					
2. Checkride Score	-.80	.81	.15	--				
3. Post-Confidence Rating	72.73	20.90	.58**	.22	--			
Final Checkride								
4. Pre-Confidence Rating	69.99	18.48	.49**	.07	.50**	--		
5. Checkride Score	-.53	.93	.20	.23	.27*	.30**	--	
6. Post-Confidence Rating	75.99	17.72	.49**	.13	.57**	.72**	.34**	--

36. DECELERATION/ACCELERATION

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	79.79	14.51	--					
2. Checkride Score	.16	.85	.06	--				
3. Post-Confidence Rating	79.58	15.75	.48**	.07	--			
Final Checkride								
4. Pre-Confidence Rating	77.62	15.64	.41**	.09	.41**	--		
5. Checkride Score	.17	.73	-.04	.18	.04	.17	--	
6. Post-Confidence Rating	79.45	14.69	.34**	-.12	.56**	.73**	.25*	--

37. ENGINE FAILURE AT ALTITUDE

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	73.50	18.16	--					
2. Checkride Score	-.05	1.05	.14	--				
3. Post-Confidence Rating	85.83	17.67	.71**	.10	--			
Final Checkride								
4. Pre-Confidence Rating	70.92	18.10	.59**	.12	.65**	--		
5. Checkride Score	.10	.76	.11	.17	.13	.13	--	
6. Post-Confidence Rating	76.99	17.56	.53**	-.04	.70**	.81**	.16	--

Note. $*p < .05$; $**p < .01$. Number of subjects = 75-78 except where noted otherwise.

38. HIGH RECONNAISSANCE

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	73.30	17.67						
2. Checkride Score	.06	.85	-.12	--				
3. Post-Confidence Rating	73.44	16.49	.58**	-.03	--			
Final Checkride								
4. Pre-Confidence Rating	73.44	16.49	.46**	-.06	.44**	--		
5. Checkride Score	.43	.53	.08	-.09	.18	.12	--	
6. Post-Confidence Rating	79.09	15.29	.44**	-.01	.59**	.82**	.24*	--

39. CONFINED AREA OPERATIONS

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	74.63	16.48	--					
2. Checkride Score	-.12	.89	-.06	--				
3. Post-Confidence Rating	77.05	15.99	.63**	.03	--			
Final Checkride								
4. Pre-Confidence Rating	73.50	15.47	.45**	.04	.44**	--		
5. Checkride Score	.23	.59	.11	.01	.26	.14	--	
6. Post-Confidence Rating	79.35	14.73	.42**	.04	.56**	.76**	.31**	--

40. PINNACLE/RIDGELINE OPERATIONS

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	71.88	17.47	--					
2. Checkride Score	.00	.95	-.16	--				
3. Post-Confidence Rating	76.45	16.18	.63**	.03	--			
Final Checkride								
4. Pre-Confidence Rating	72.19	15.44	.46**	.13	.49**	--		
5. Checkride Score	.04	.72	.12	-.13	.11	.23	--	
6. Post-Confidence Rating	78.42	15.24	.36**	.01	.50**	.71**	.31**	--

41. TERRAIN FLIGHT MISSION PLANNING

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	67.69	18.71	--					
2. Checkride Score	.17	.83	-.10	--				
3. Post-Confidence Rating	75.05	18.80	.73**	-.18	[illegible]			
Final Checkride								
4. Pre-Confidence Rating	[illegible]	18.56	.32**	-.01	[illegible]	[illegible]		
5. Checkride Score	[illegible]	.40	-.04	.01	[illegible]	[illegible]		
6. Post-Confidence Rating	77.38	15.04	.31**	[illegible]	.48**	[illegible]	[illegible]	--

Note. *p < .05; **p < .01. Number of subjects = 75-78 except where [illegible] otherwise.

42. TERRAIN FLIGHT NAVIGATION

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	70.06	17.97	--					
2. Checkride Score	.01	1.00	-.17	--				
3. Post-Confidence Rating	75.87	16.82	.77**	-.01	--			
Final Checkride								
4. Pre-Confidence Rating	71.60	17.64	.42**	-.10	.45**	--		
5. Checkride Score	.34	.74	.15	-.00	.18	.04	--	
6. Post-Confidence Rating	78.91	15.45	.40**	-.25**	.52**	.76**	.27**	--

43. LOW-LEVEL FLIGHT

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	75.82	16.22	--					
2. Checkride Score	.32	.77	-.15	--				
3. Post-Confidence Rating	79.58	15.77	.79**	-.12	--			
Final Checkride								
4. Pre-Confidence Rating	75.99	16.35	.39**	.03	.55**	--		
5. Checkride Score	.47	.51	.06	-.17	.18	.12	--	
6. Post-Confidence Rating	80.90	13.91	.39**	-.18	.59**	.73**	.26*	--

44. NOE FLIGHT

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	75.14	19.04	--					
2. Checkride Score	.25	.80	-.24*	--				
3. Post-Confidence Rating	78.16	17.05	.75**	-.15	--			
Final Checkride								
4. Pre-Confidence Rating	73.59	16.92	.47**	-.08	.54**	--		
5. Checkride Score	.41	.60	.07	-.12	.08	.11	--	
6. Post-Confidence Rating	80.91	13.53	.36**	-.10	.58**	.73**	.26*	--

45. NOE DECELERATION

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	68.99	19.97	--					
2. Checkride Score	-.27	.89	-.08	--				
3. Post-Confidence Rating	72.50	20.11	.74**	.12	--			
Final Checkride								
4. Pre-Confidence Rating	68.88	19.19	.44**	.14	.52**	--		
5. Checkride Score	-.04	.86	.13	.06	.15	.02	--	
6. Post-Confidence Rating	75.50	18.42	.33**	.28*	.68**	.62**	.15	

Note. *$p < .05$; **$p < .01$. Number of subjects = 75-78 except where noted otherwise.

46. TERRAIN FLIGHT APPROACH

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	70.74	19.23	--					
2. Checkride Score	.07	.89	-.06	--				
3. Post-Confidence Rating	76.95	17.25	.70**	-.04	--			
Final Checkride								
4. Pre-Confidence Rating	73.10	17.45	.36**	.04	.47**	--		
5. Checkride Score	.45	.50	.12	-.00	.24*	.26*	--	
6. Post-Confidence Rating	80.30	14.75	.27*	-.09	.52**	.72**	.33**	--

47. OUT-OF-GROUND EFFECT CHECK

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	71.64	18.72	--					
2. Checkride Score	-.40	.98	.02	--				
3. Post-Confidence Rating	74.04	17.66	.62**	.03	--			
Final Checkride								
4. Pre-Confidence Rating	73.60	17.27	.39**	.13	.33**	--		
5. Checkride Score	.09	.85	-.06	.06	-.07	.18	--	
6. Post-Confidence Rating	78.19	17.20	.32**	-.08	.51**	.69**	.19	--

48. TERRAIN FLIGHT TAKEOFF

Variable	M	SD	1	2	3	4	5	6
Initial Checkride								
1. Pre-Confidence Rating	74.21	18.80	--					
2. Checkride Score	-.05	.81	-.11	--				
3. Post-Confidence Rating	79.21	14.74	.61**	-.10	--			
Final Checkride								
4. Pre-Confidence Rating	75.61	15.65	.27*	.08	.48**	--		
5. Checkride Score	.32	.65	.07	.28*	.01	.10	--	
6. Post-Confidence Rating	80.86	14.86	.27*	-.03	.62**	.72**	.08	--

Note. *p < .05; **p < .01. Number of subjects = 75-78 except where noted otherwise.